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SPECIFICATIONS

■ POWER AMP SECTION

CIRCUIT SYSTEM Switched A/B type all stage direct coupled pure complementary SEPP OCL circuit

DYNAMIC POWER (IHF, 8Ω/200W)

OUTPUT	20Hz ~ 20kHz	70W x 2
20Hz ~ 20kHz	B Class, 8Ω	85W x 2
Both Channels Driven	B Class, 4Ω	15W x 2
1kHz (Both Channels Driven)	A Class, 8Ω	15W x 2
	B Class, 8Ω	75W x 2
	B Class, 4Ω	100W x 2
	A Class, 8Ω	15W x 2
1kHz (One Channel Driven)	B Class, 8Ω	80W
	B Class, 4Ω	100W
	A Class, 8Ω	15W

TOTAL HARMONIC DISTORTION

B Class at Rated Output	0.1%
B Class at 1W Output	0.04%
A Class at Rated Output	0.1%
A Class at 1W	0.02%

INTERMODULATION DISTORTION (70Hz:7kHz=4:1)

B Class at Rated Power	0.1%
B Class at 1W	less than 0.05%
A Class at Rated Power	0.1%
A Class at 1W	less than 0.05%

POWER BANDWIDTH

(IHF, Both Channels Driven 0.05%)	B Class	5Hz ~ 50kHz
	A Class	5Hz ~ 100kHz

FREQUENCY RESPONSE

B Class	10Hz ~ 100kHz ±1dB
A Class	10Hz ~ 100kHz ±1dB

INPUT SENSITIVITY

B Class	775mV
A Class	330mV

INPUT IMPEDANCE

OUTPUT TERMINALS	40kΩ
Speaker Terminals	A, B, C, A+B, A+C
Headphone Jack	4Ω ~ 16Ω

DAMPING FACTOR

(1kHz, 8Ω)	70
S/N RATIO	
(IHF, A Network)	100dB
Residual Noise (8Ω, Pre-Amp + Power Amp)	0.8mV

■ PRE-AMP SECTION

CIRCUIT SYSTEM

Equalizer Amp	FET, SRPP Input
Microphone Amp	Tr. SEPP Output
	Two-transistor direct coupled amp.
Control Amp	Intermediate emitter-follower type

INPUT SENSITIVITY AND IMPEDANCE

Phono 1	MIC 200μV/100Ω
	3mV/50kΩ 100kΩ
Phono 2	3mV/50kΩ
Phono Maximum	
Input Capacity (at 1kHz)	310mVrms (870mVp-p)
Mic.	2.5mV/50kΩ
Tuner	120mV/40kΩ
Aux. 1, 2	120mV/40kΩ
Tape PB A, B	120mV/40kΩ

OUTPUT LEVEL AND IMPEDANCE

Tape Rec Out A, B	120mV/2kΩ
Pre Out	775mV/2kΩ

FREQUENCY RESPONSE

Phono (RIAA equalization)	30Hz ~ 15kHz ±0.2dB
	20Hz ~ 20kHz +0.5dB, -2dB
Mic.	10Hz ~ 50kHz +0.5dB, -1dB
Tuner, Aux, Tape PB	

TONE CONTROLS

Bass	50Hz ±15dB
	250Hz, 500Hz ±3dB
Treble	10kHz ±10dB
	2.5kHz, 5kHz ±3dB
	-20dB

AUDIO MUTING

FILTERS

Low	20Hz, 70Hz (12dB/oct.)
High	6kHz, 12kHz (6dB/oct.)
LOUDNESS CONTROL	Continuous loudness control to be treated as loudness curve

S/N RATIO

(IHF, A Network)	
Phono 1	MC 70dB
	50kΩ, 100kΩ 80dB
Phono 2	80dB
Mic.	70dB
Tuner, Aux, Tape	90dB

■ AUXILIARY CIRCUITS

Transistorized Protector Circuit (ASO detection limiter system)	
Speaker Protection Circuit (Voltage direction relay drive system)	
Operation Switch	A Class/B Class switchover
Tape Dubbing Switch	
Continuous Loudness	

■ GENERAL

Power Source	AC 110, 117, 130, 220, 240 V
	50 ~ 60Hz
Power Consumption	
Rated	
CANADIAN MODEL	320W
U.S. MODEL	400VA
EXCEPT U.S. & CANADIAN MODELS	250W
Max.	420W
AC Outlets	Switched (2) Max. 200W
	Unswitched (2) Max. 200W

■ DIMENSIONS

	436(W) x 144(H) x 323mm (D)
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■ WEIGHT

	15.5kg
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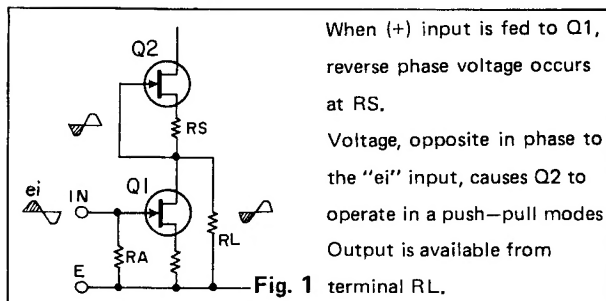
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CIRCUIT DESCRIPTIONS

1. SRPP (SHUNT-REGULATED PUSH-PULL) CIRCUIT

Features: Thanks to efficient use of power this circuit features a large dynamic range. Superior frequency response, lower noise and distortion ratio in following stages due to higher output impedance.

The SRPP circuit provided the above features to pre-amps during the tube era. It is composed of DC elements in series, but if we look at it as an AC circuit from the load side, the top and bottom elements appear to be AC, connected in parallel, so that the input impedance is high and output impedance low.



In this circuit Q2 serves as load resistance for Q1 by using the gain from the FET's high output impedance. Furthermore, it is designed for a high RL factor. This is to handle the high gain with less distortion. In addition to a low distortion ratio, high S/N ratio, large input capacity and precise RIAA characteristics, the CA-1000 equalizer amp is not influenced by broadcast signals even in high field strength areas, and will accept various types of cartridges. These features are all assured by the primary FET stage. Because these elements provides characteristics close to those assured by squared factors, that random harmonic distortion is reduced and noise characteristics, especially pulse noise is extremely low. Noise factor in the transistor-collector current is minimal (near $10\mu\text{A}$), so that ideally the equalizer amp primary stage current should be near this figure, except that this would make it difficult to provide sufficient input power. Drain current does not affect this figure, either, so it can be decreased by the supply of more current.

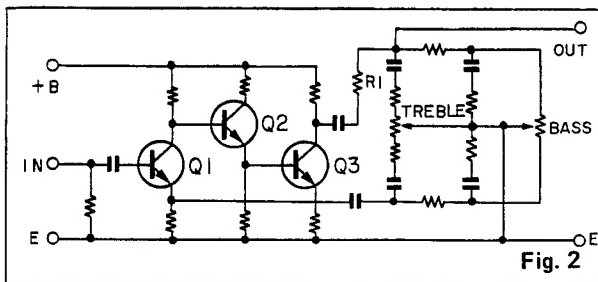
The CA-1000 is designed for 1mA drain current, so that primary amp stage input is dozens of times greater than the transistor's $10\mu\text{A}$.

These excellent FETs were not used in high-fidelity amplifiers until now because of their smaller gain per unit, and because the IDSS (gate shutoff current) scatter was too large. It has also been difficult to

gather data on the best characteristics for tube and transistor systems, yet this unit uses a combination of two selected FETs in the SRPP circuit for outstanding performance characteristics.

2. SPECIAL YAMAHA TONE CONTROL SYSTEM

This circuit is composed of a CR damping circuit, used generally in audio equipment, of the negative feed back type.



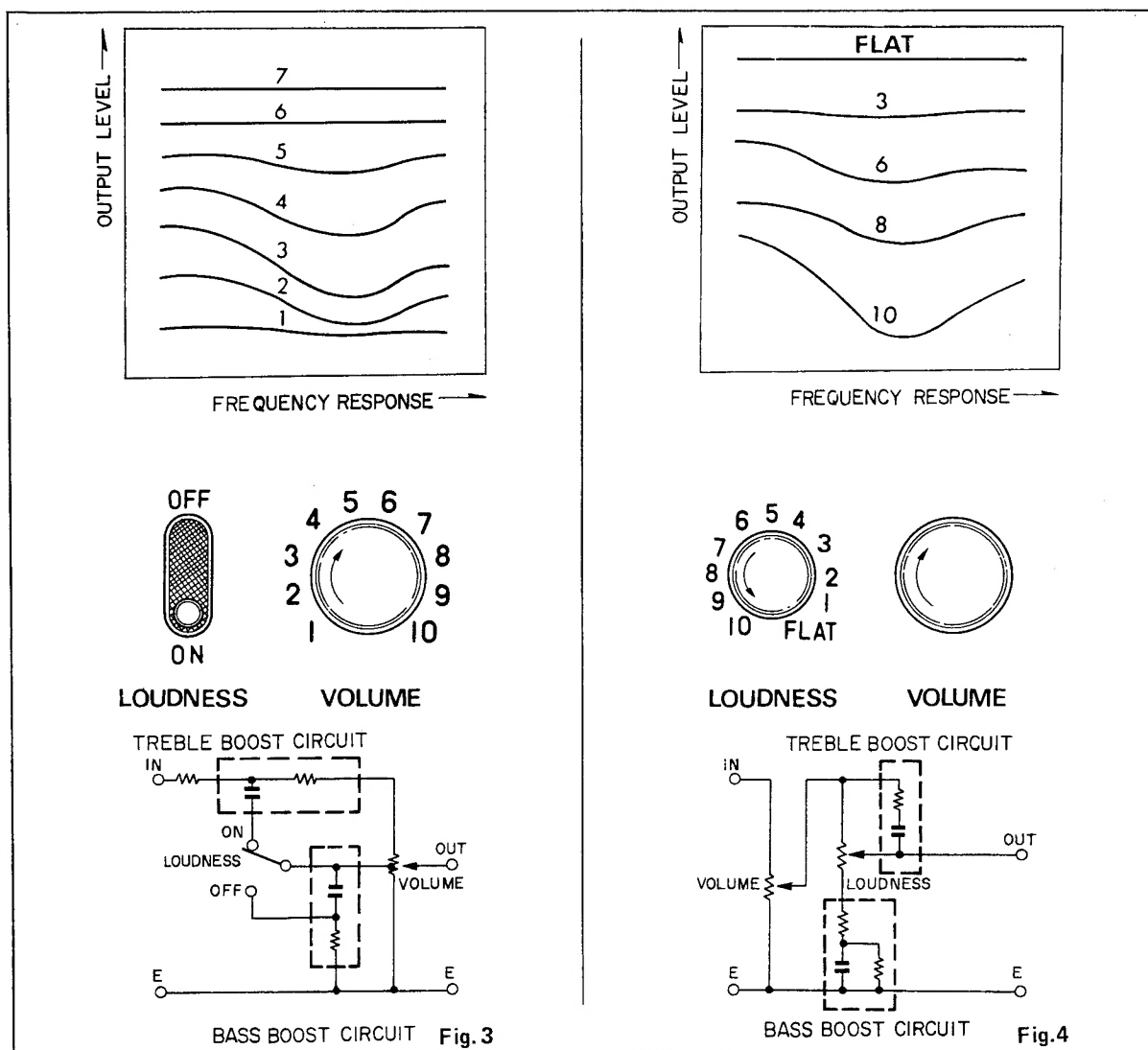
When the treble from the circuit shown in the figure is boosted, the parallel-coupled impedance in the first stage Q1 emitter rises in range and is reduced in amount. In other words, the NF decreases, boosting the treble tones. On the other hand, to cut the treble a special treble damping effect is produced by lowering the impedance of the contact point between the R1 (connected to the last stage collector) and the output terminal. Bass tone control is carried out in the same way.

Because the CA-1000 is the same as the first-quality three-stage direct-coupled equalizer amplifiers used in the most expensive audio equipment, the S/N ratio is superb and distortion is almost unmeasurably low. In addition, when the tone controls are set for flat response, gain at 25dB is 50dB negative feedback for outstanding stability.

3. CONTINUOUS LOUDNESS CIRCUIT

The continuous loudness circuit used in the CA-1000 corrects the weak point found in conventional loudness controls; its effect is graduated according to the volume control setting for ideal loudness characteristics at any volume level.

A conventional loudness circuit, as shown in the figure, is a time constant circuit connected to the middle volume tap. Its characteristics are changed according to the volume control setting as shown in Fig. 3, but it is impossible to adjust it to match speaker performance or room acoustics. The continuous loudness circuit in the CA-1000, however, is a circuit connected behind the volume circuit (actually, behind the tone control circuit). This solves the above problem, allowing the listener to use the circuit to achieve ideal listening characteristics. (Fig. 4)



4. A CLASS AND B CLASS OPERATION

The trend today is toward amplifiers with larger and larger output power, and this is one of the most important themes in new product development. Almost 100% (except for a few exceptions) of the solid state hi-fi amps now on sale employ B Class (strictly speaking, AB Class) operation. Yet engineers trying to combat audio distortion are constantly troubled by the crossover distortion and notch distortion present in B Class amps.

In the CA-1000 a great deal of effort has been spent to decrease high-range distortion while maintaining sufficient negative feedback stability. As a result, distortion between 20Hz and 100kHz has been reduced to less than 0.015% (Fig. 5). Only in A

Class amps can one find higher stability, better performance and lower crossover or notch distortion. (Fig. 6)

An A Class amp. is only common sense when one wants a small signal circuit, while the B Class is for high power. The B Class amp. boasts higher efficiency, provides relatively more output than the capacity loss in its power transistors, has lower ripple due to reduced current at no signal, has a better S/N ratio and is less sensitive to heat than the A Class amp. Nevertheless, the A Class amp. has its own merits, even through it suffers by comparison to a B Class amp. in the above ways when used as a main amp: in effect, the A Class amp. is more

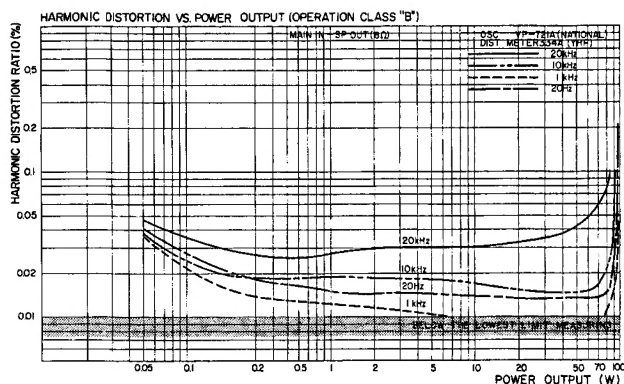


Fig. 5

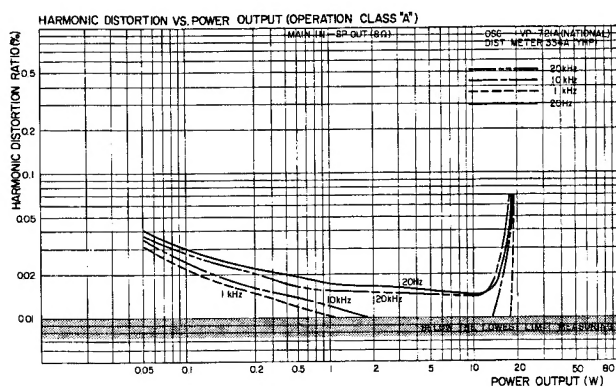
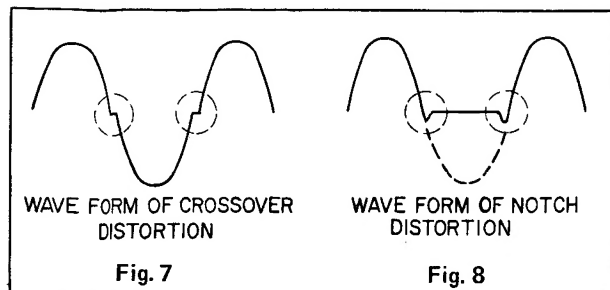


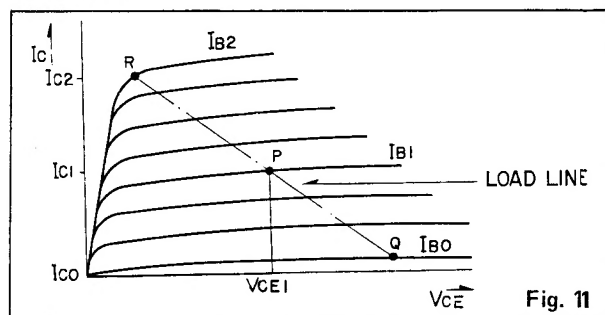
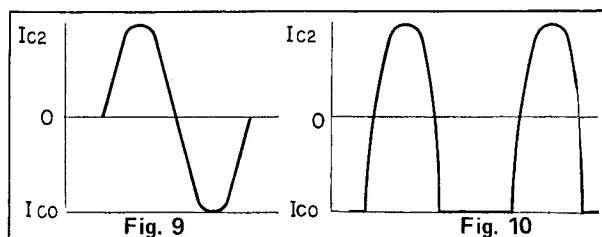
Fig. 6

faithful to the original signal. In other words, this system is much less susceptible to unstable performance and hence inferior tone quality. There is theoretically no crossover or notch distortion, and sharply reduced high range distortion. Let us examine crossover and notch distortion more carefully. Crossover distortion occurs if there is no signal current flow at the instant of changeover between positive and negative in a given cycle, during the B Class push-pull operation. In other words, when one transistor is changing from On to Off, the other transistor will be a bit late in switching from Off to On, as shown in Fig. 7. This is caused by non-linearity in the signal transfer characteristics when the transistor collector current is small. To minimize this problem an idling current has been designed.



Notch distortion refers to the pulse distortion illustrated in Fig. 8. It occurs because of incomplete transistor switching, and is one of the most difficult problems inherent to solid state amplifiers. The high frequency elements of this distortion are also 5~10 times the 2nd harmonic or even higher than the audible range.

Finally, let us examine the differences between A Class and B Class amps in theory. The difference for classification purposes is in the bias setting. In an A Class amp. the mid-point P is set as the operation point where the direct load, drawn from the transistor static characteristics, is divided into two. Transistor base bias current is I_{B1} when there is no input



signal, as shown in Fig. 11, and I_{C1} is continually flowing in the collector. Between the collector and emitter voltage V_{CE1} is added. Add a sine wave input signal to this transistor and then, when the base current is deflected from I_{B0} to I_{B2} collector current changes from I_{C0} to I_{C2} and a sine wave current with maximum amplitude $I_{C2} - I_{C0}$ is provided as shown in Fig. 9. In this way, when the amplifier output waveform operates for full negative and positive waves of the input signal, the operation is called A Class. In contrast with this, when the transistor bias is the base current I_{B0} and set to point Q to cut off practically all the collector current, then when a sine wave input signal, causing maximum deflection in I_{B2} , is added, base current is deflected from I_{B0} to I_{B2} for half the wave, but for the other half it does not flow due to opposite bias. For this reason the collector current changes to the performance shown in Fig. 10, Only following during one half of each input sine wave. This operation, using only half the input waveform, is

called B Class amplification.

A Class amplification is basically single operation, but output is only 2~3W; therefore a push-pull circuit is used for larger output. B Class operation,

as shown above, is amplification using only half the waveform. Therefore, to get a full waveform the push-pull circuit is also used here. See Figs. 12~14.

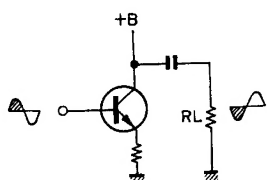


Fig. 12. A Class Single Circuit

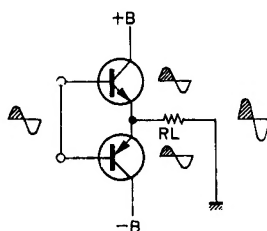


Fig. 13. A Class Push-Pull Circuit

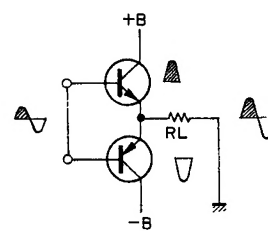


Fig. 14. B Class Push-Pull Circuit

5. PROTECTION CIRCUITS

■ Transistor Protection Circuit

The transistor protection circuit guards against transistor damage due to excessive current from a load short. In the CA-1000 a Darlington connection is used to regulate the input power flowing to the power transistor. This system has the advantage of working very quickly and protecting the transistor against overload by acting within an average of μ second. This circuit checks both power transistor emitter resistance voltage and collector voltage drop, regulating the power transistor drive signal via the control transistor. When the load resistance drops below 4Ω the power transistor current is cut, which also radically lowers the output power for transistor protection. If there is a complete short in the output terminal, the current flowing in the power transistor averages 1.3A. To aid in discovering the cause of the short, the power does not go completely off; output merely drops considerably.

■ Speaker Protection Circuit

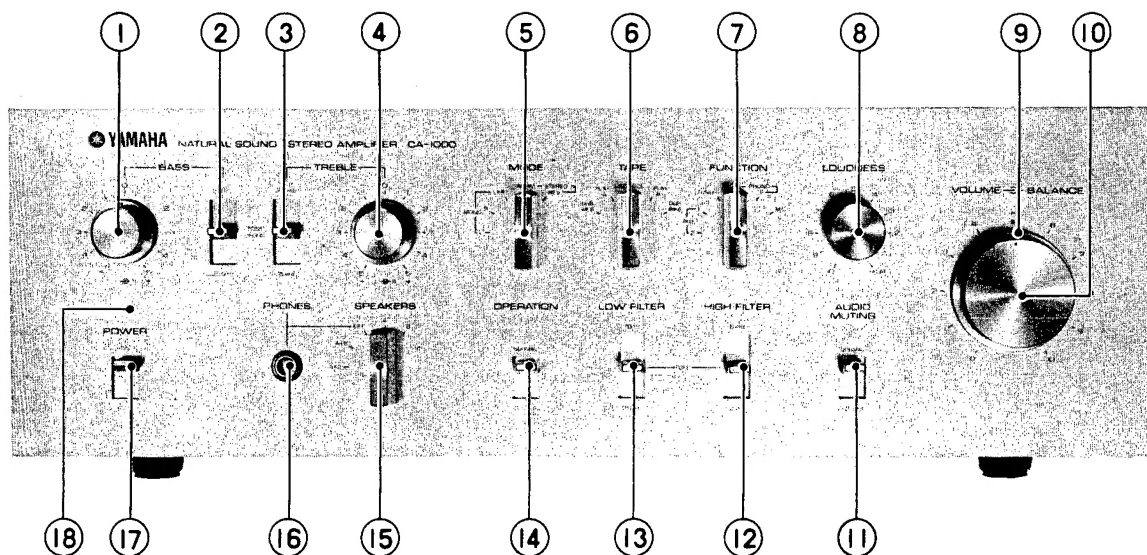
Note: Refer to the general circuit diagram power circuit.

This protection system is also unique to Yamaha. When (+) DC electric potential appears at either the left or right output terminal, the TR707 base is affected by the bias so that this transistor will be on, while TR708 and 709 will be off. Therefore the relay circuit goes off to protect the speakers.

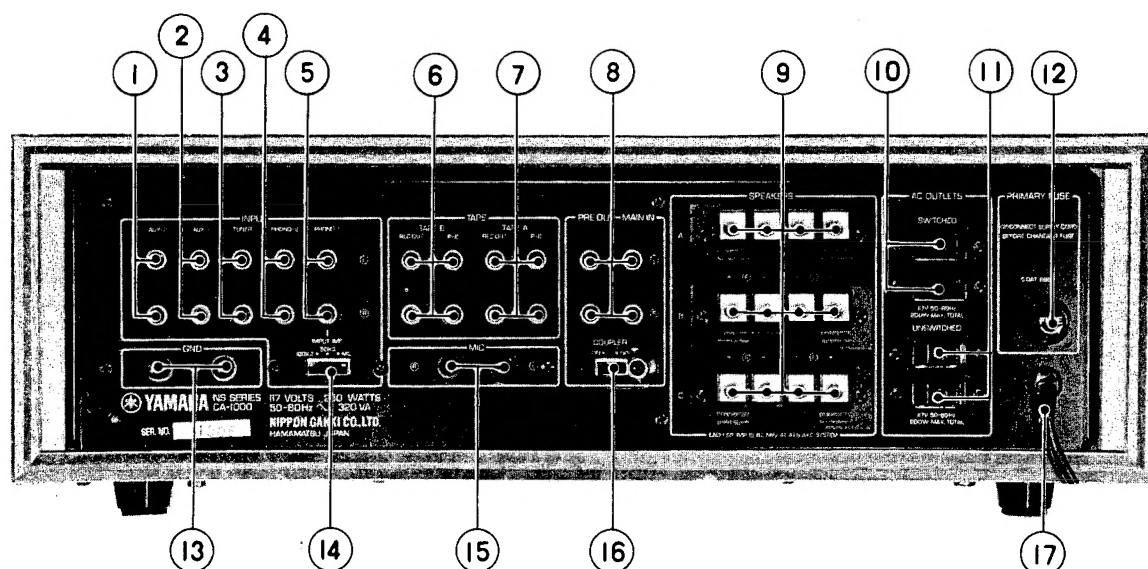
If there is a (-) DC electric potential, TR705 and 706 go on and operate in the same way. To avoid unpleasant shock noise when the switch is turned on a muting circuit is provided. This circuit switches on due to electric potential gain from the mid-point of the power sheet +B D704 and D706, with the time constant controlled by C715 and R721. After 4~5 seconds the TR709 base potential turns the transistor on, at the same time turning TR708 on and powering the relay.

EXTERNAL VIEW

FRONT PANEL



REAR PANEL



FRONT PANEL

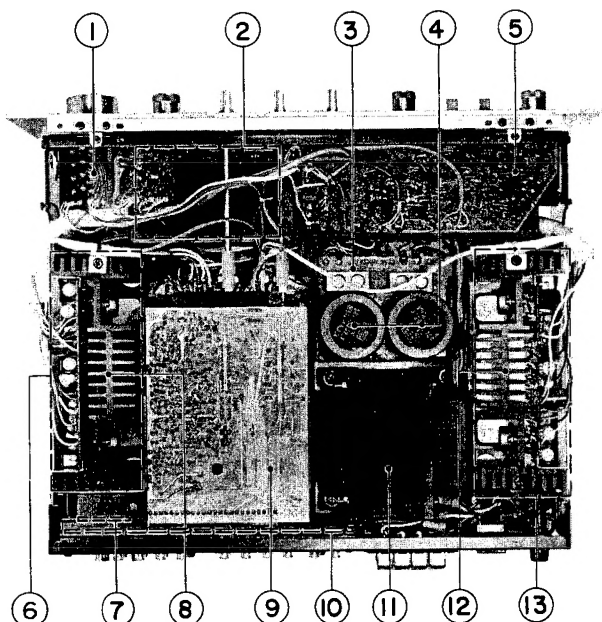
- ① BASS TONE CONTROL
- ② BASS TURNOVER SWITCH
- ③ TREBLE TURNOVER SWITCH
- ④ TREBLE TONE CONTROL
- ⑤ MODE SELECTOR
- ⑥ TAPE SELECTOR
- ⑦ FUNCTION SELECTOR
- ⑧ LOUDNESS CONTROL
- ⑨ BALANCE CONTROL
- ⑩ VOLUME CONTROL
- ⑪ AUDIO MUTING SWITCH
- ⑫ HIGH FILTER SWITCH
- ⑬ LOW FILTER SWITCH
- ⑭ A CLASS/B CLASS OPERATION SWITCH
- ⑮ SPEAKER SELECTOR
- ⑯ HEADPHONE JACK
- ⑰ POWER SWITCH
- ⑱ PILOT LAMP

REAR PANEL

- ① AUX-2 INPUT JACKS
- ② AUX-1 INPUT JACKS
- ③ TUNER INPUT JACKS
- ④ PHONO-2 (Turntable) INPUT JACKS
- ⑤ PHONO-1 (Turntable) INPUT JACKS
- ⑥ TAPE-B JACKS
- ⑦ TAPE-A JACKS
- ⑧ PRE OUT/MAIN IN JACKS
- ⑨ SPEAKER TERMINALS
- ⑩ AC OUTLETS (SWITCHED)
- ⑪ AC OUTLETS (UNSWITCHED)
- ⑫ PRIMARY FUSE
- ⑬ GROUND TERMINAL
- ⑭ INPUT IMPEDANCE SWITCH
- ⑮ MICROPHONE JACKS
- ⑯ COUPLER SWITCH
- ⑰ AC CORD

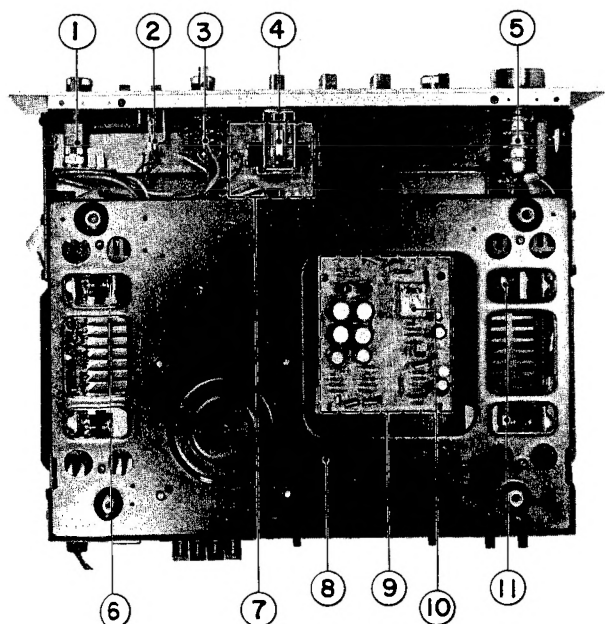
INTERNAL VIEW

TOP VIEW



- ① ELECTROLYTIC CAPACITOR (NA06336)
- ② FILTER CIRCUIT BOARD (NA06338)
- ③ ELECTROLYTIC CAPACITOR CIRCUIT BOARD (NA06352)
- ④ ELECTROLYTIC CAPACITOR (18,000 μ F/63WV)
- ⑤ TONE CONTROL CIRCUIT BOARD (NA06337)
- ⑥ MAIN AMP CIRCUIT BOARD
NA06331: EXCEPT EUROPEAN MODEL
NA06388: EUROPEAN MODEL
- ⑦ MC AMP CIRCUIT BOARD (NA06339)
- ⑧ HEAT SINK
- ⑨ FUNCTION CIRCUIT BOARD (NA06335)
- ⑩ REAR PANEL CIRCUIT BOARD (NA06333)
- ⑪ POWER TRANSFORMER (GA60530)
- ⑫ HEAT SINK
- ⑬ MAIN AMP CIRCUIT BOARD

BOTTOM VIEW

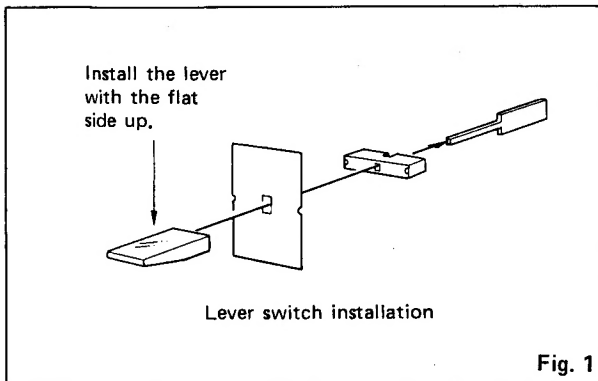


- ① POWER SWITCH CIRCUIT BOARD
NA06375: EXCEPT EUROPEAN MODEL
NA06376: EUROPEAN MODEL ONLY
- ② HEADPHONE JACK
- ③ SPEAKER SELECTOR
- ④ OPERATION SWITCH
- ⑤ VARIABLE RESISTOR (Volume/Balance Control:
HB250k Ω x 2 WITH CENTER CLICK A100k Ω x 2)
- ⑥ POWER TRANSISTOR
- ⑦ OPERATION SWITCH CIRCUIT BOARD (NA06354)
- ⑧ CHASSIS
- ⑨ POWER CIRCUIT BOARD (NA06332)
- ⑩ SPEAKER PROTECTION CIRCUIT RELAY (HC-2P)
- ⑪ POWER TRANSISTOR

PARTIAL DISASSEMBLY

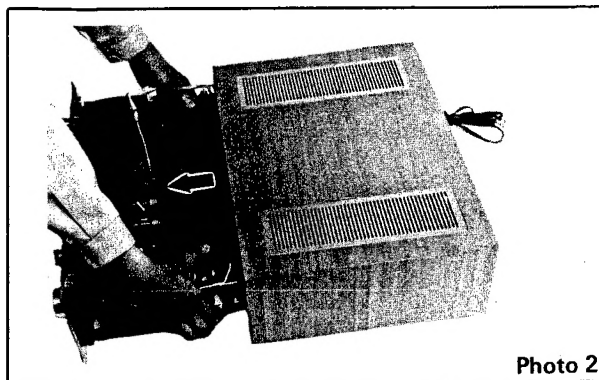
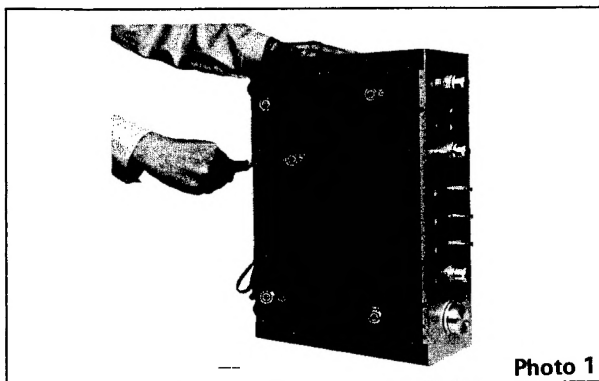
BEFORE DISASSEMBLY

- The screwdriver for each screw should match the screw size. If you use a smaller or larger size it will damage the groove.
 - If you use excessive force on the printed circuit board it will crack or cut the print wiring, so be careful.
 - When using a soldering iron finish all work as quickly as possible.
- Be careful not to install switches and knobs in the wrong place or upside-down. See Fig. 1.



CABINET REMOVAL

- Remove screws 1~5 as shown in Photo 1.
- Remove the cabinet as shown in Photo 2.



MC AMP CIRCUIT BOARD REMOVAL

- Remove the two MC amp circuit board holder screws.
- Pull up the MC amp circuit board in the direction of the arrow as shown in Photo 3.



MAIN AMP UNIT REMOVAL

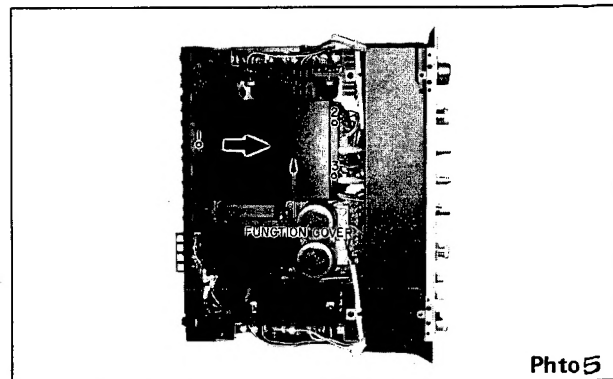
- Remove screws 1, 2 as shown in Photo 4.
- Pull up the main amp unit in direction of the arrow to remove it as shown in Photo 4.

Note: Be careful not to cut the lead cord connected to the main amp circuit board.



FUNCTION CIRCUIT BOARD

- Loosen screws 1~3 and slide the function circuit board cover in the direction of arrow to remove it as shown in Photo 5.



- b. Slide the joints toward the front panel, then remove the function circuit board from the extension shaft as shown in Photo 6.

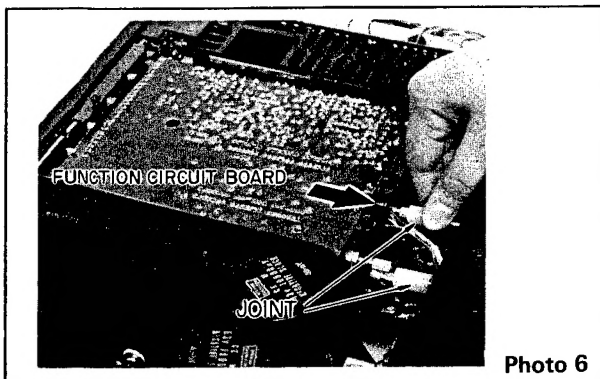


Photo 6

- c. Loosen screws 1, 2 shown in Photo 7.

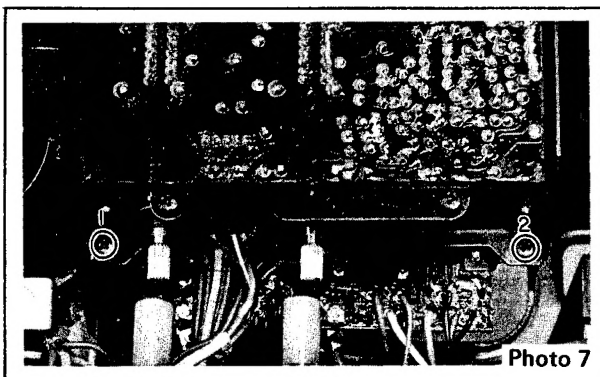


Photo 7

- d. Insert a screwdriver into the hole in the function circuit board as shown in Photo 8 and pull in the direction of the arrow. Remove the function circuit board/rear panel connector.

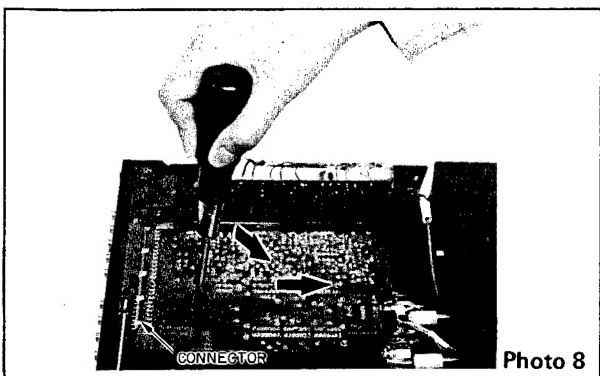


Photo 8

- e. Remove the two CIS connectors from the rear panel and the one connected to the front panel, then remove the function circuit board as shown in Photo 9.

Note: When reinstalling the function circuit board, set the FUNCTION and TAPE switches to the same positions, then add the joint.

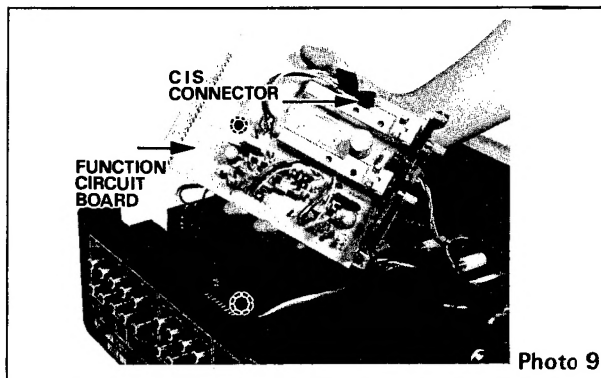


Photo 9

POWER CIRCUIT BOARD REMOVAL

- a. Turn the chassis upside down.
b. Remove screws 1, 2 shown in Photo 10, then slide the power circuit board in the direction of the arrow to remove it as shown in Photo 11.

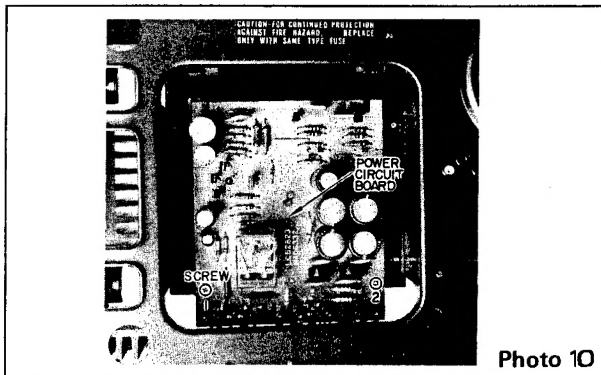


Photo 10

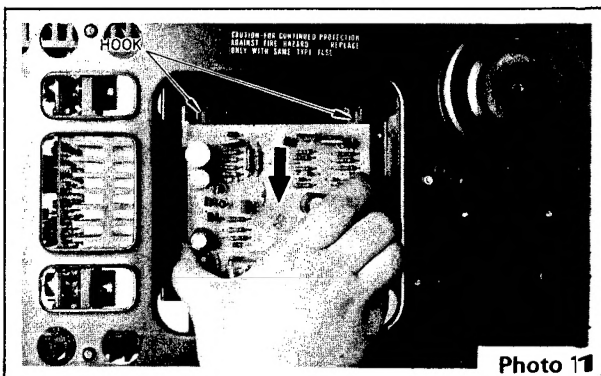
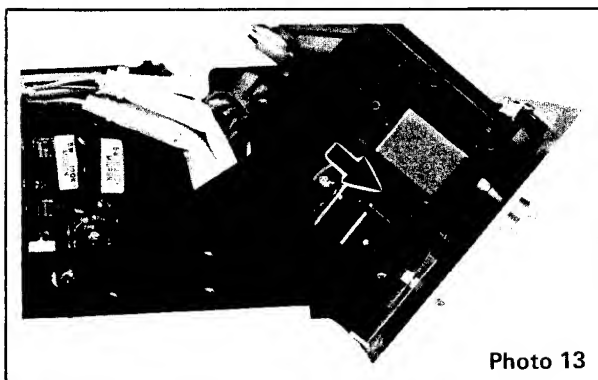
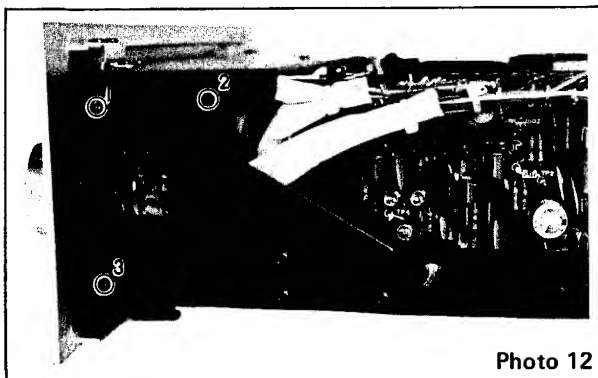


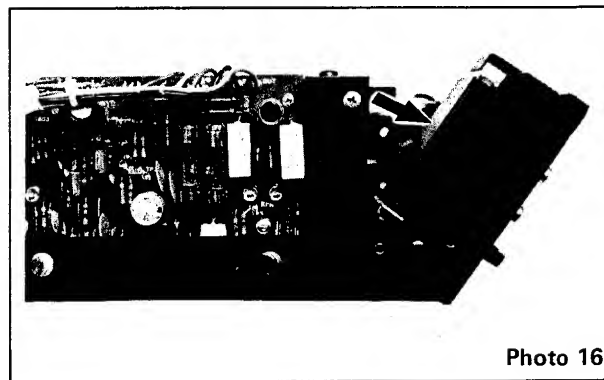
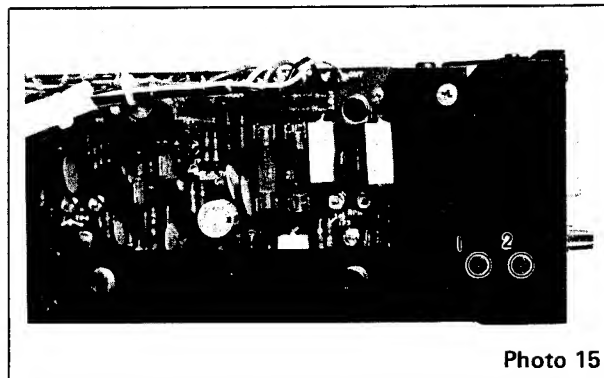
Photo 11

SUB CHASSIS UNIT TILTING

- a. Remove screw 1 and loosen screws 2, 3 shown in Photo 12, then slide down the sub chassis unit as shown in Photo 13.

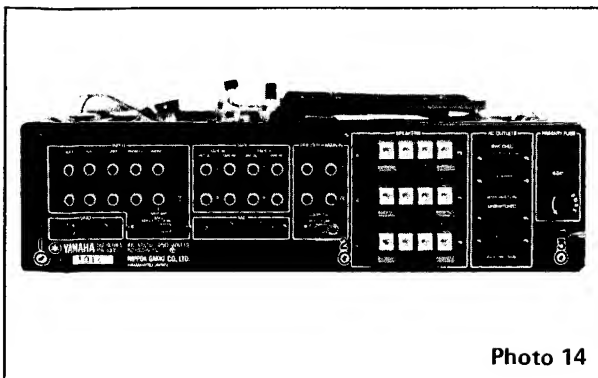


- c. Remove screw 1 and loosen screw 2 shown in Photo 15, then tilt down the rear panel as shown in Photo 16.



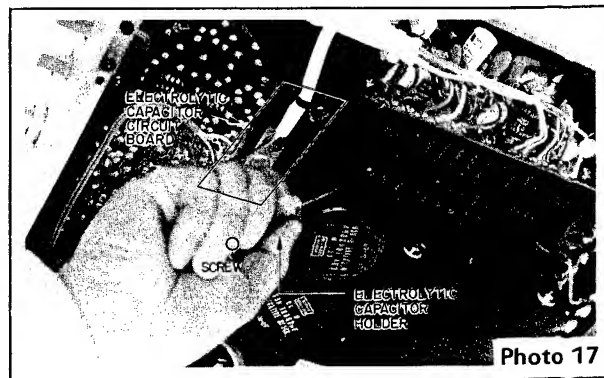
REAR PANEL TILTING

- a. Remove the function circuit board (refer to Photo 5~9).
- b. Remove screws 1~3 shown in Photo 14.



ELECTROLYTIC CAPACITOR CIRCUIT BOARD REMOVAL

- a. Tilt the sub chassis unit down (refer to Photo 12, 13).
- b. Remove screw shown in Photo 17, then pull the electrolytic capacitor holder up and remove it.



- c. Slide the electrolytic capacitor circuit board toward the front panel, pull it up and remove it.

FRONT PANEL REMOVAL

- Remove screw 1 and loosen 2~5 as shown in Photo 18. Then remove the shield board.
- Remove all knobs by pulling. Use a hexagonal wrench to loosen the nuts on the MODE, FUNCTION, TAPE and SPEAKER knobs.
- Remove screws 1~4 shown in Photo 19.

Note: The switch aprons are of varying sizes, so be careful not to confuse them during reinstallation. Install as shown in Photo 20.

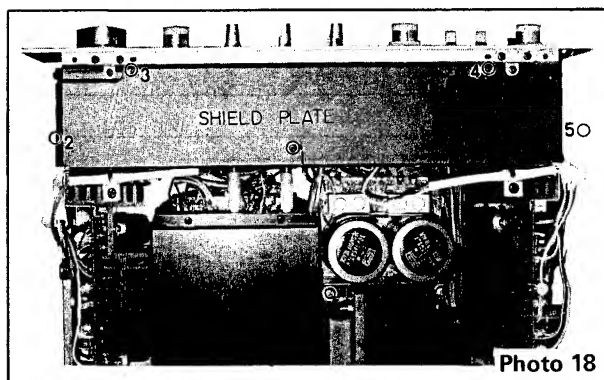


Photo 18

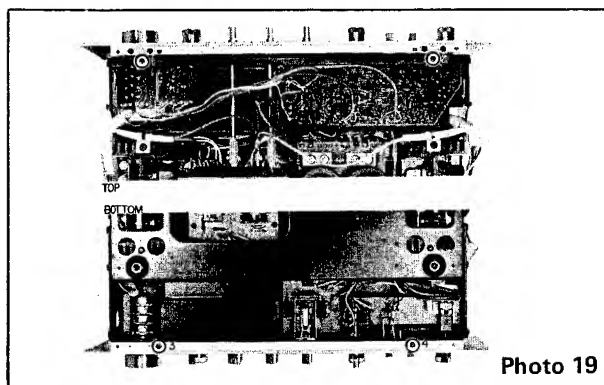


Photo 19

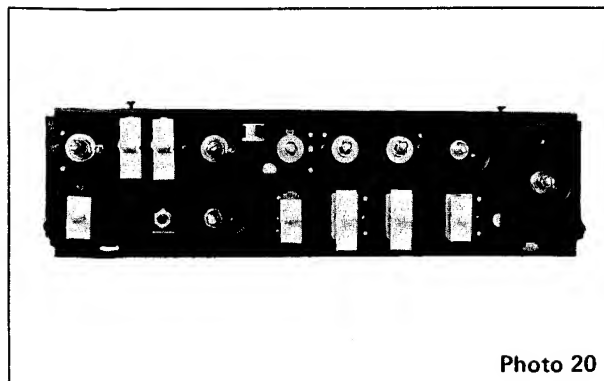


Photo 20

tone control circuit board removal

- Remove the front panel and tilt down the sub chassis.
- Remove screws 1~4 shown in Photo 21 and pull the circuit board with the shield case back to remove it.
- Loosen screws 1, 2 shown in Photo 22 and slide the shield case in the direction of the arrow to remove it.
- Pull out the CIS connector leading to the function circuit board.
- To separate the tone control circuit board from its holder, remove nuts 1~3 and screws 1~4 as shown in Photo 23.

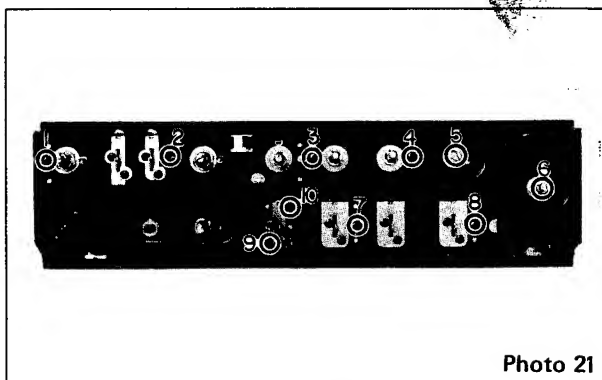


Photo 21

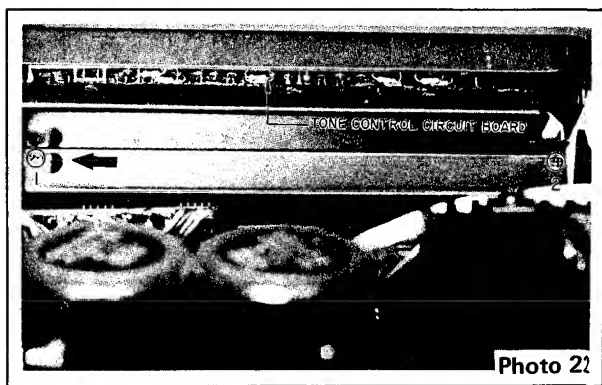


Photo 22

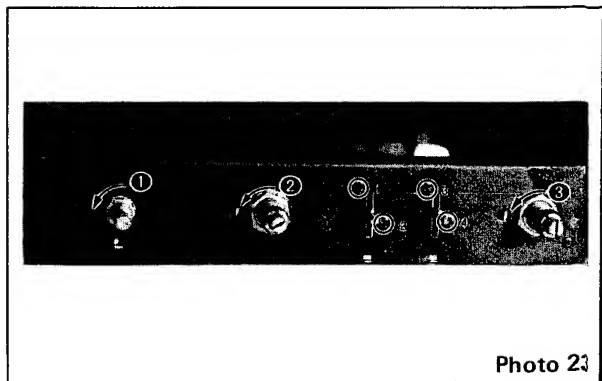


Photo 23

VOLUME CIRCUIT BOARD REMOVAL

- a. Remove the nuts 5, 6 shown in Photo 21, then pull the volume circuit board back to remove it.

FILTER CIRCUIT BOARD REMOVAL

- a. Remove the front panel and tilt down the sub chassis.
- b. Remove the tone control circuit board and shield board.
- c. Remove screws 7, 8 shown in Photo 21, then remove the filter circuit board and shield board.
- d. Remove two screws from the rear bottom of the filter circuit board shield board, then remove the filter circuit board.

OPERATION SWITCH CIRCUIT BOARD REMOVAL

- a. Remove the front panel and tilt the sub chassis forward.
- b. Pull off the two CIS connectors.
- c. Remove screws 9, 10 shown in Photo 21, then pull back the operation switch circuit board to remove it.

POWER SWITCH CIRCUIT BOARD REMOVAL

- a. Remove the front panel and tilt the sub chassis forward.
- b. Remove the tone control circuit board and shield case.
- c. Remove screws 1, 2 shown in Photo 24 and then remove the power switch circuit board.
- d. At this time, slide the lamp holder to the right as shown in Photo 25, and remove it. When reinstalling the pilot lamp, be careful that it is not placed too far forward so that it touches the front panel; it should not be too far from the lamp holder.

REAR PANEL CIRCUIT BOARD REMOVAL

- a. Remove the function circuit board.
- b. Tilt the rear panel down.
- c. Pull out the CIS connector, and disconnect the chassis earth lead connected to chassis.
- d. Remove screws 1~8 as shown in Photo 25, then remove the rear panel circuit board.
- e. Remove screws 1~5 as shown in Photo 26.
- f. If the rear panel circuit board is further disassembled, follow the procedure shown in Photo 27.

CABINET ASSEMBLY

- a. First put the power cord into the cabinet, then assembly it and the chassis, paying attention to the lead harness.
- b. When all parts are safely in the cabinet, reinstall the screws in reverse order. Lift the unit a bit to be sure of correct installation.

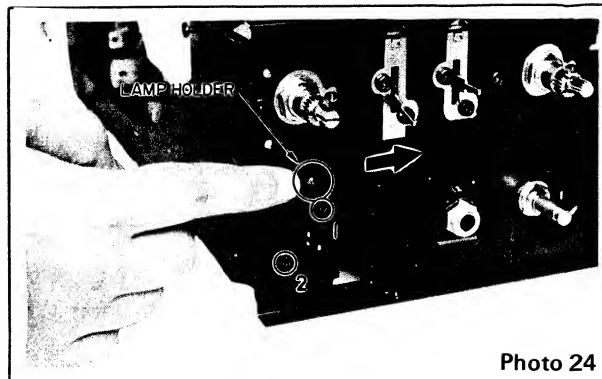


Photo 24

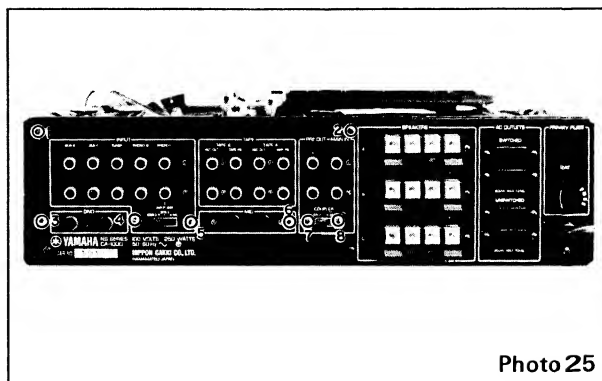


Photo 25

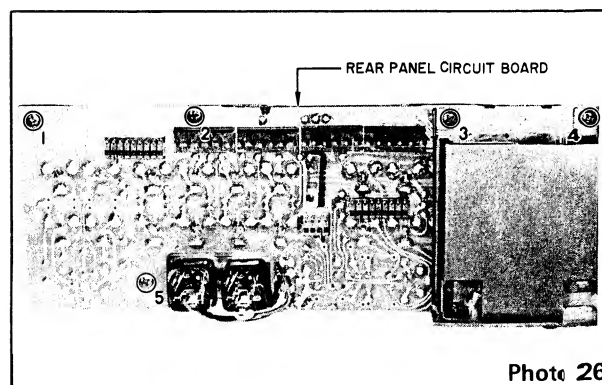


Photo 26



Photo 27

ADJUSTMENT OF EACH CIRCUIT BOARD

BEFORE MEASUREMENT

- Turn the Pre/Main amp. coupler switch Off.
- After the power switch is turned on, wait 3~4 minutes before measuring, to be sure of the most stable operation.
- Do not connect speakers or dummy load resistance to the speaker terminals.

1. MAIN CIRCUIT BOARD

a. Primary Stage Differential Amplification Cir-

Set the voltage between TP1 and TP2 to $15V \pm 1V$ with VR602.

TP1 : (-)

TP2 : (+)

b. Mid-Point Potential Adjustment

Set the voltage between SP Out terminal and E to $0V \pm 0.01V$ with VR601.

c. B Class Idling Current Adjustment

Set the Operation switch to Normal.

Set the voltage between TP3 and TP4 to $0.047V \pm 0.01V$ with VR603.

TP3 : (+)

TP4 : (-)

d. A Class Idling Current Adjustment

Set the Operation switch to Class A.

Set the voltage between TP3 and TP4 to $0.94V \pm 0.05V$ with VR604.

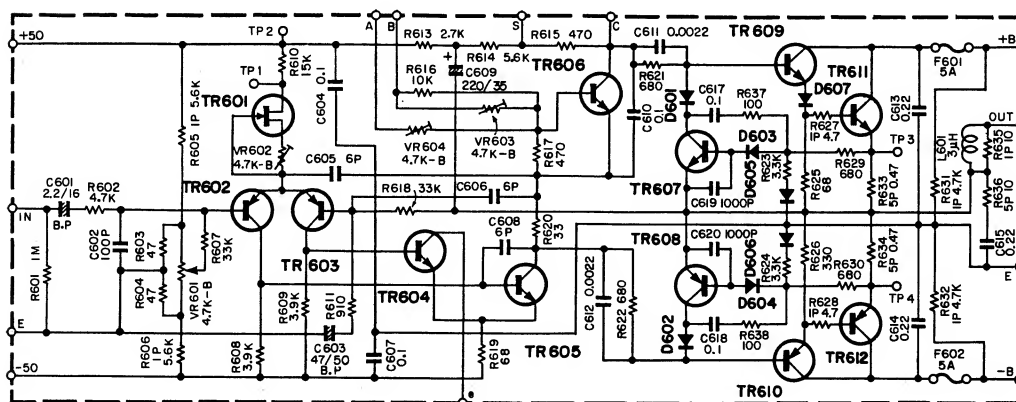
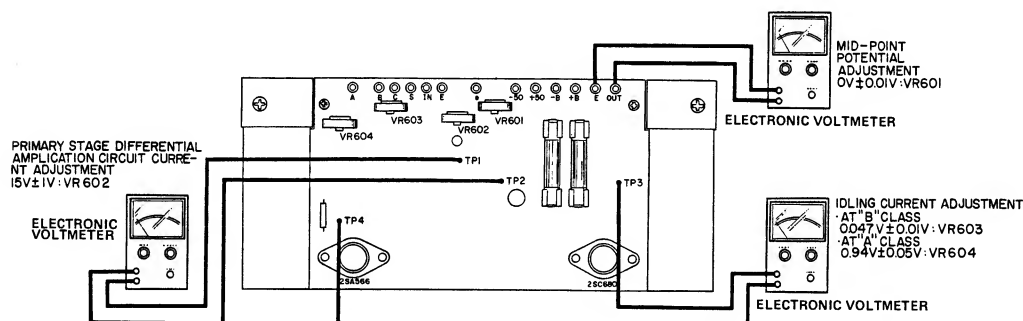
TP3 : (+)

TP4 : (-)

e. Repeat procedures a-d above several times until each is within the allowable limits.

Note • Turn the volume gently during adjustment.

• Pay close attention to the polarity of each test point.



2. FUNCTION CIRCUIT BOARD

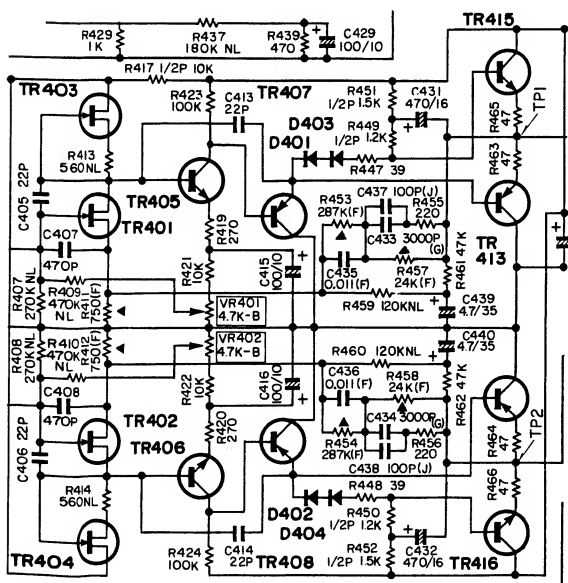
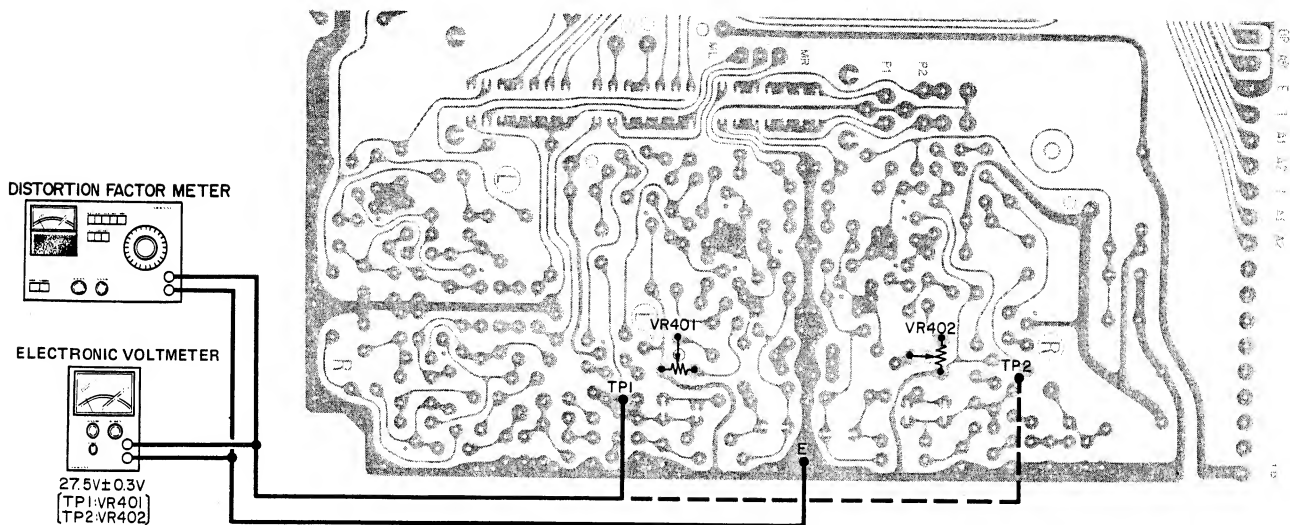
a. Equalizer SEPP Output Mid-Point Potential Adjustment.

The voltage between TP1 and TP2 on the circuit board and E should be $27.5V \pm 0.3V$ (minimum potential distortion ratio).

Adjust TP1 with VR401, TP2 with VR402.

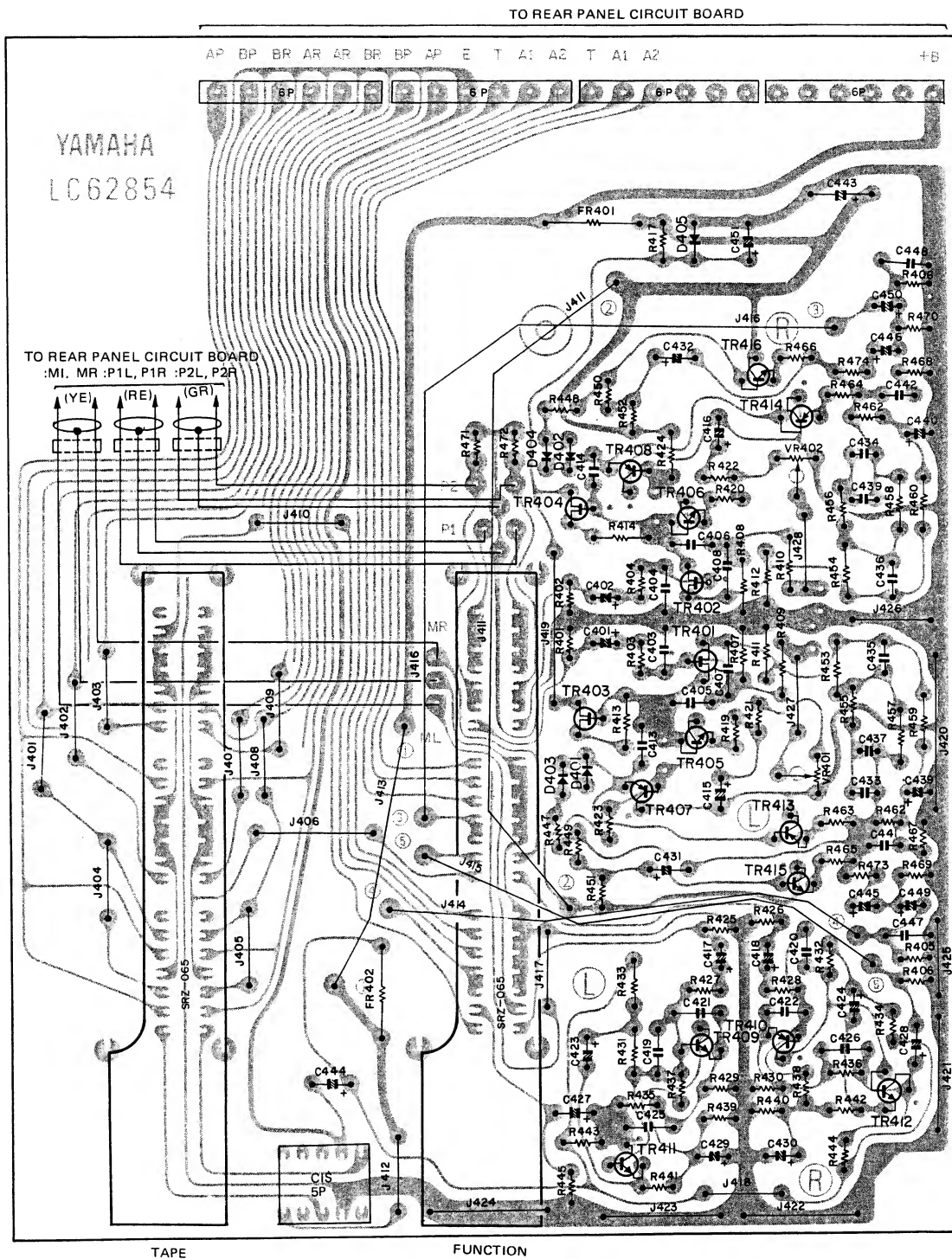
Note: • Turn the volume gently during adjustment.

- The Pre-Main coupler switch should be Off.

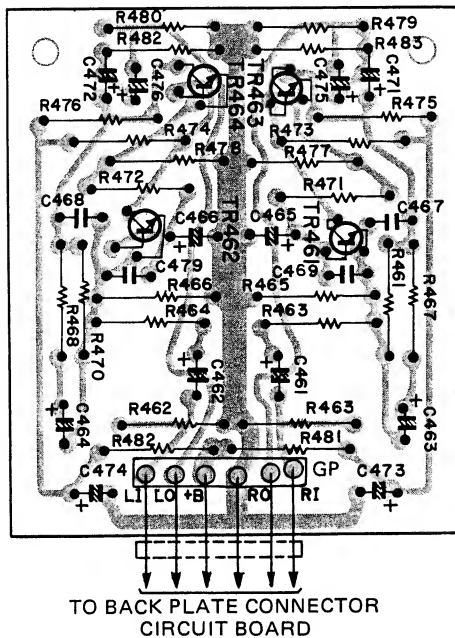


PRINTED CIRCUIT BOARDS

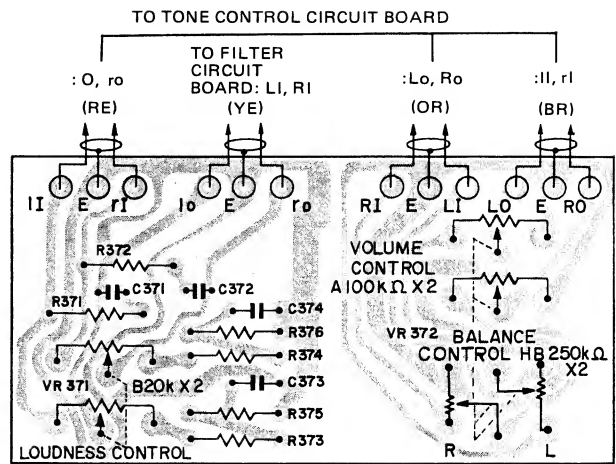
FUNCTION CIRCUIT BOARD NAO6335



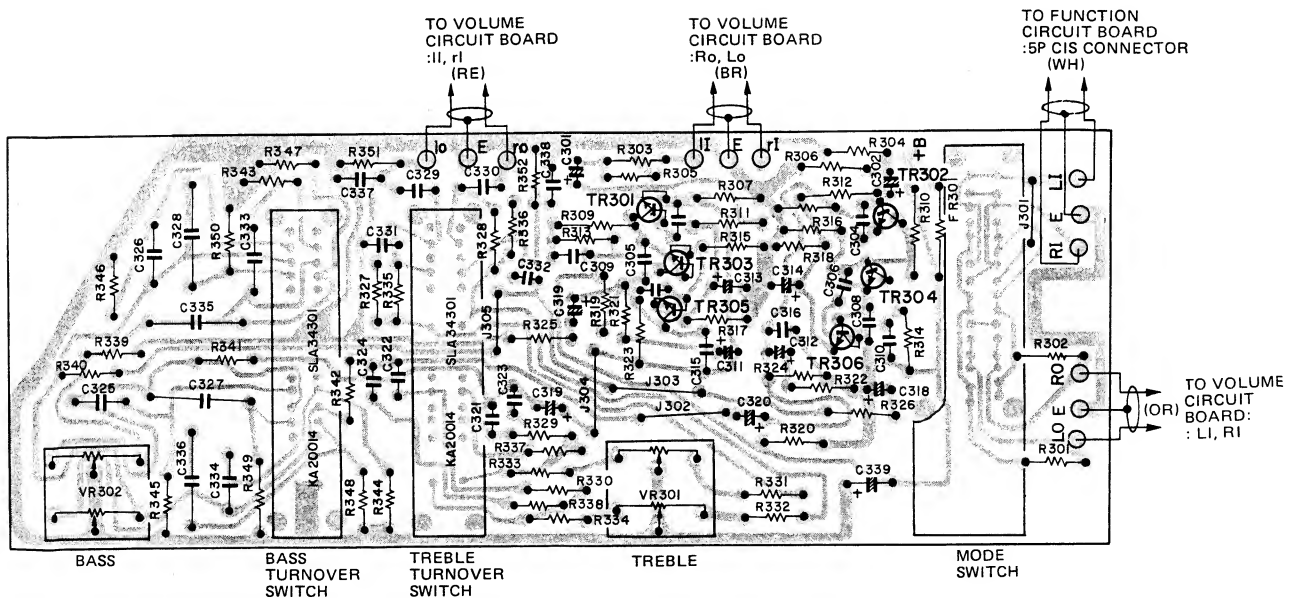
MC AMP. CIRCUIT BOARD NAO6339



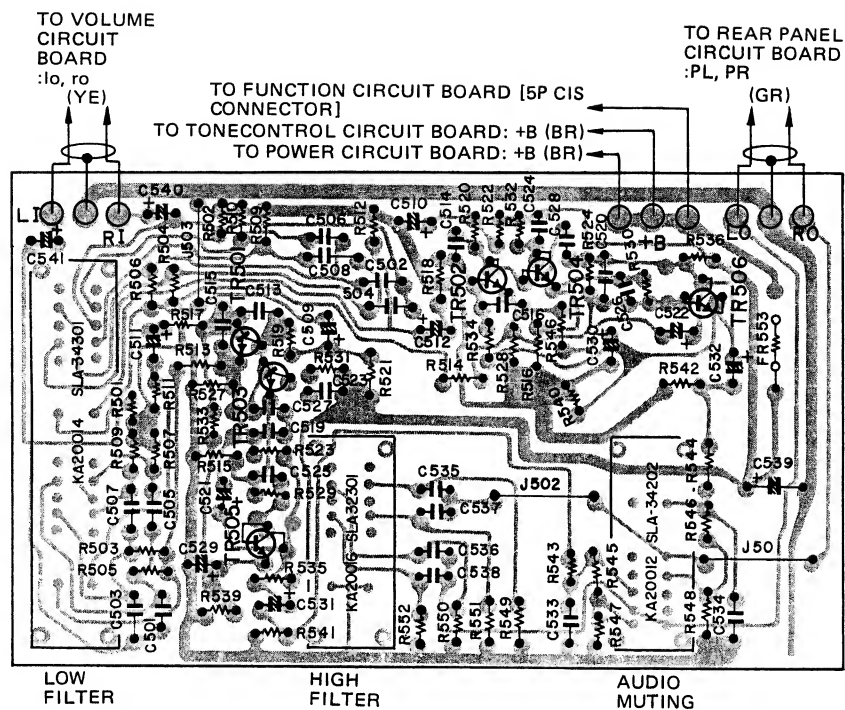
VOLUME CIRCUIT BOARD NAO6336



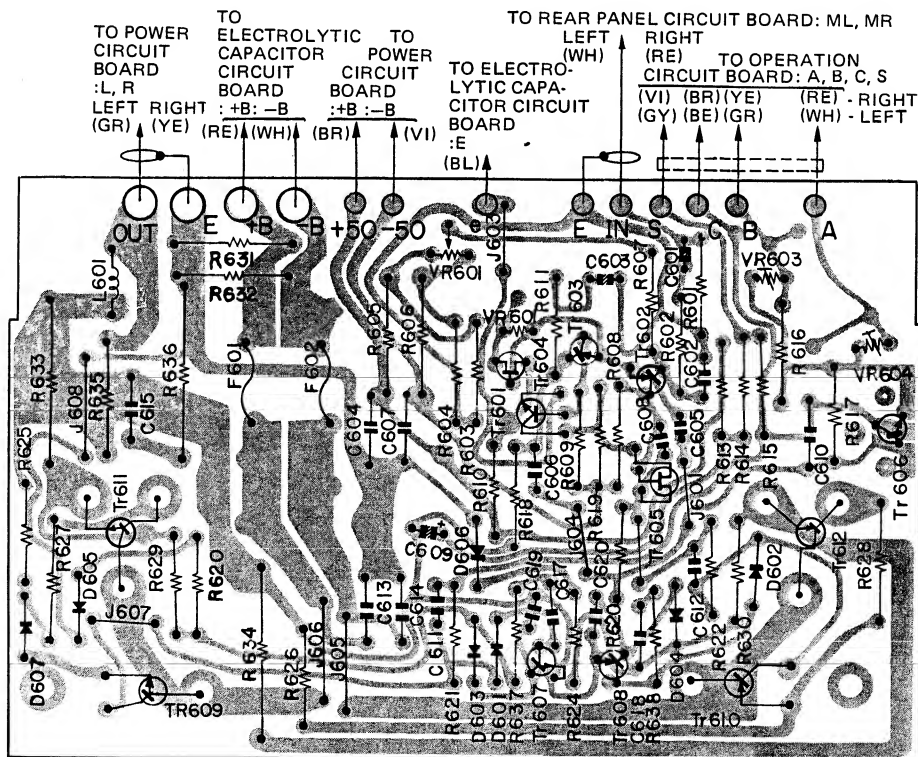
TONE CONTROL CIRCUIT BOARD NAO6337



FILTER CIRCUIT BOARD NAO6338

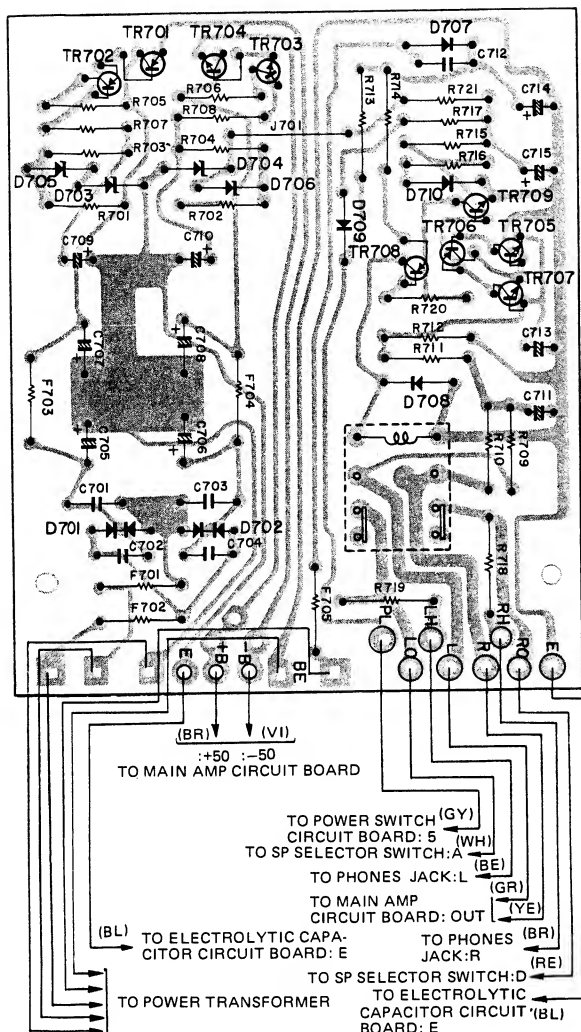


MAIN AMP. CIRCUIT BOARD NAO6331

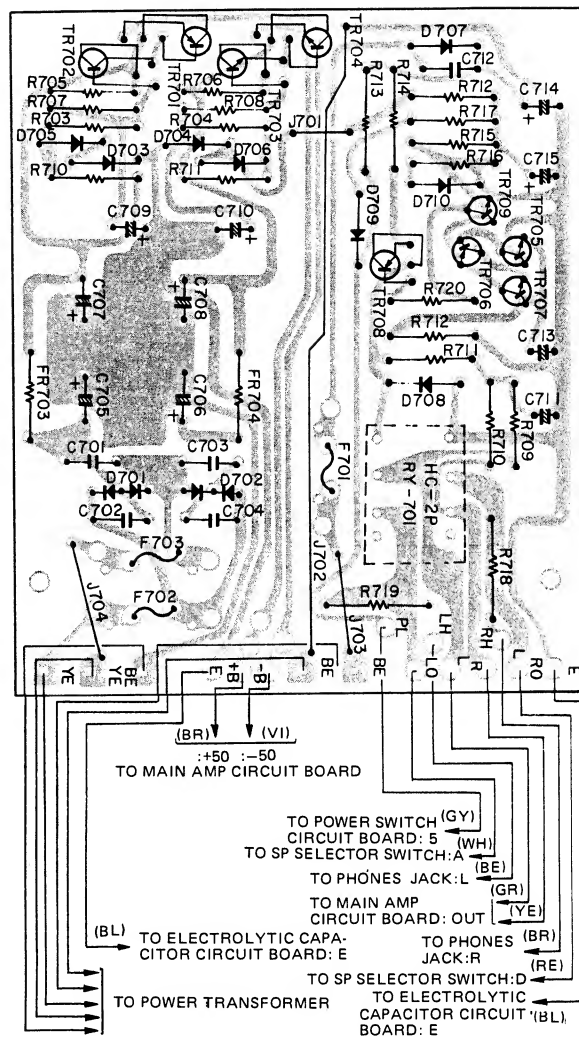


POWER CIRCUIT BOARD

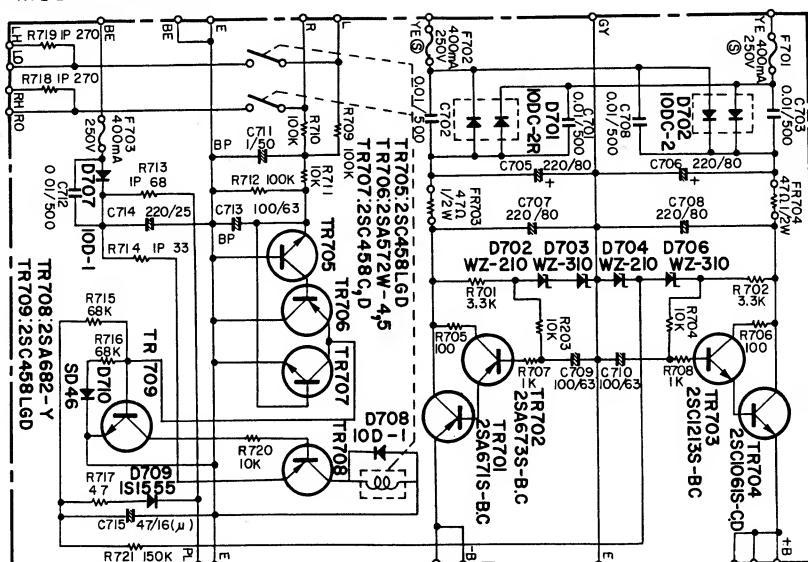
• EXCEPT CANADIAN MODEL NA06332



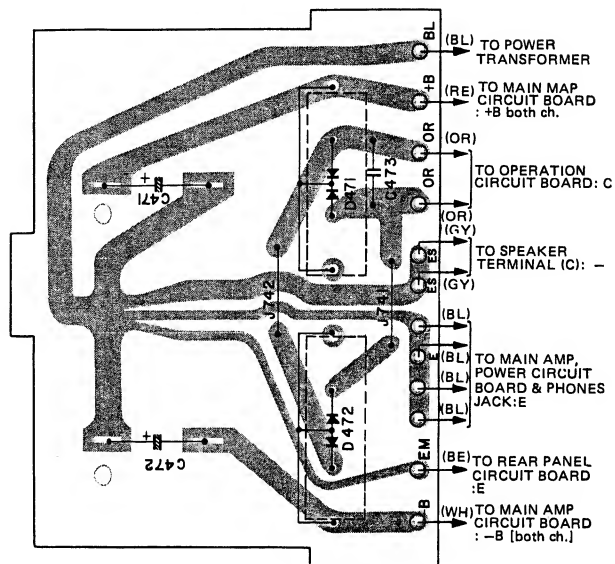
• CANADIAN MODEL



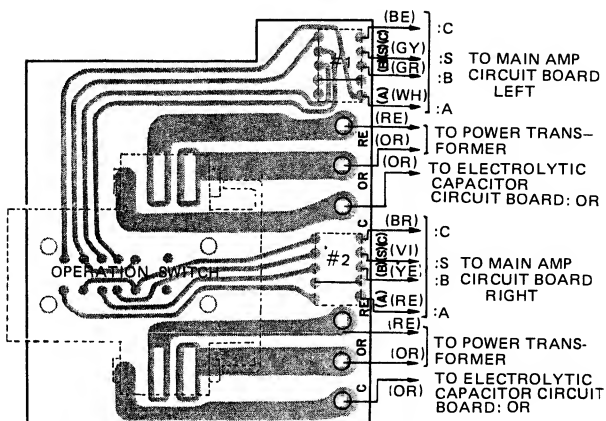
• CANADIAN MODEL NA06529



ELECTROLYTIC CAPACITOR CIRCUIT BOARD NAO6352

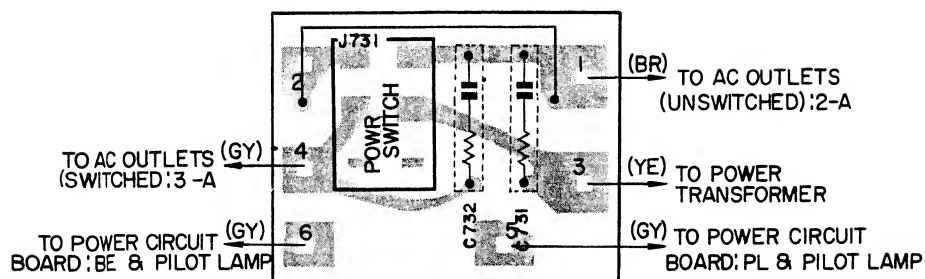


OPERATION CIRCUIT BOARD NAO6354

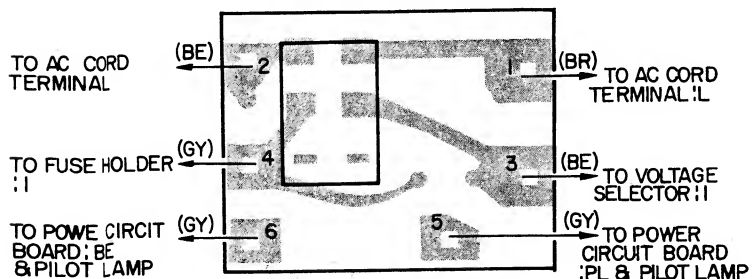


POWER SWITCH CIRCUIT BOARD.

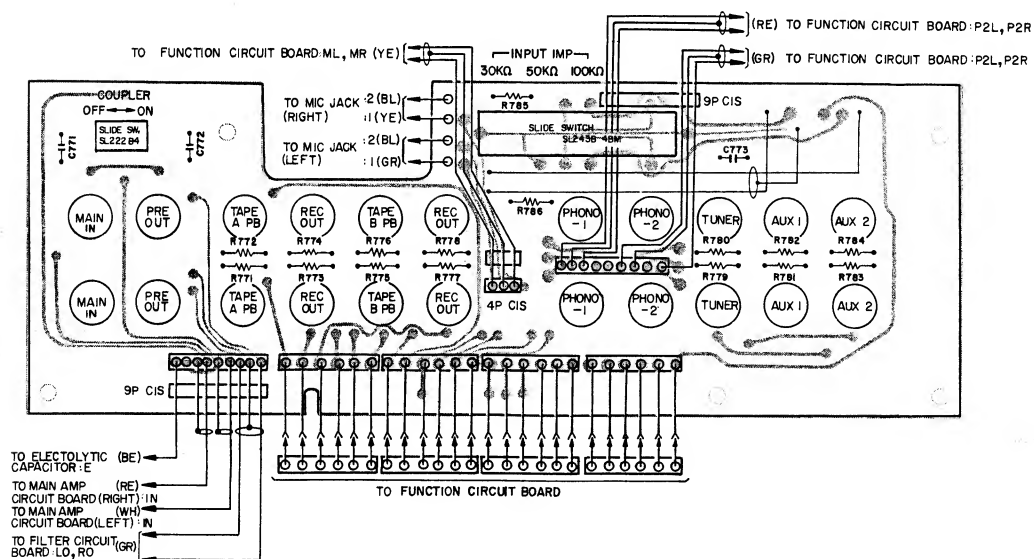
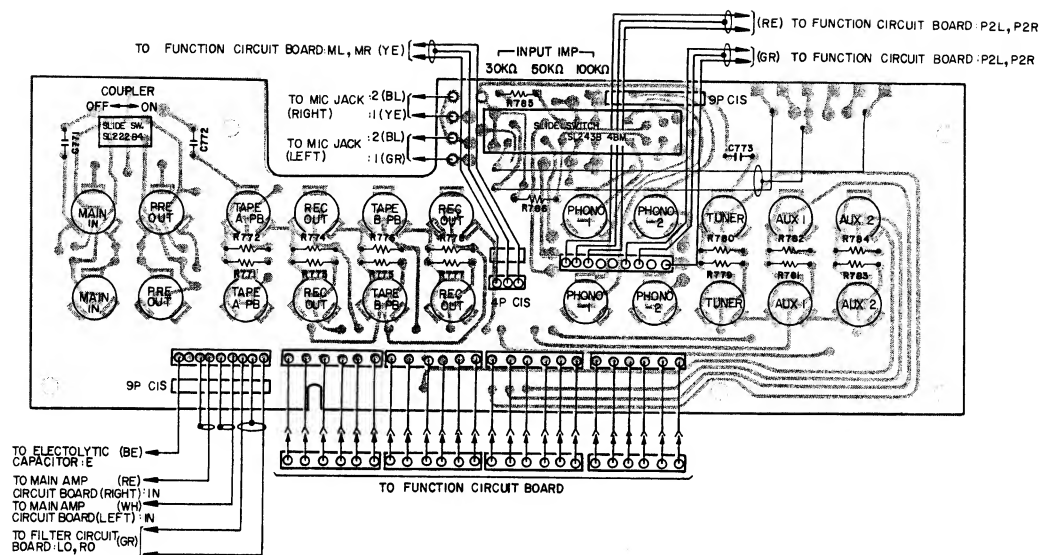
- EXCEPT EUROPEAN MODEL NAO6375



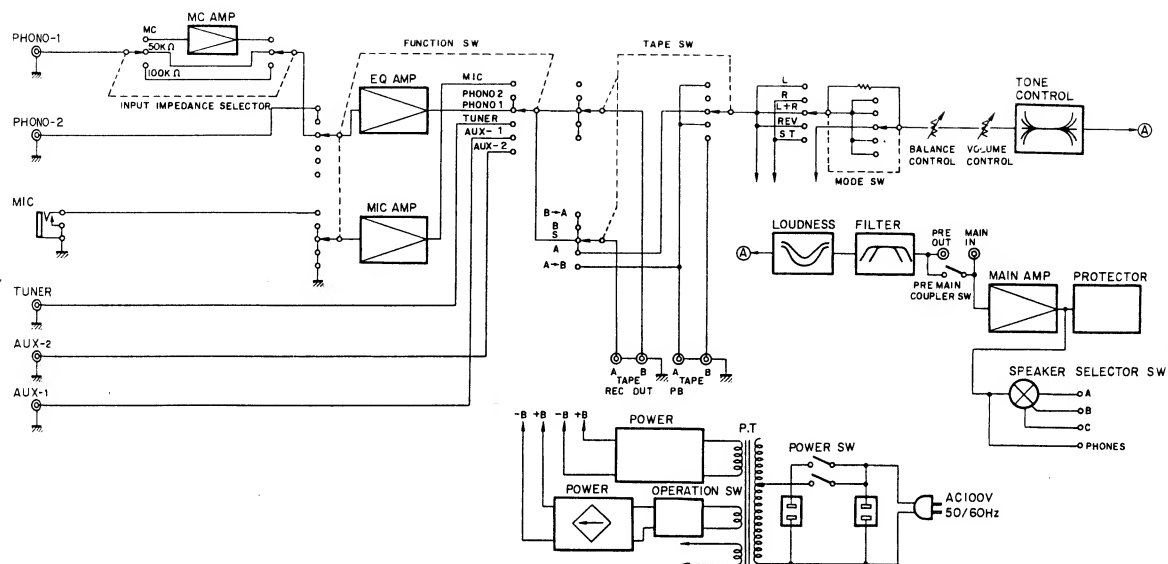
- EUROPEAN MODEL NAO6376



REAR PANEL CIRCUIT BOARD NAO6333



BLOCK DIAGRAM



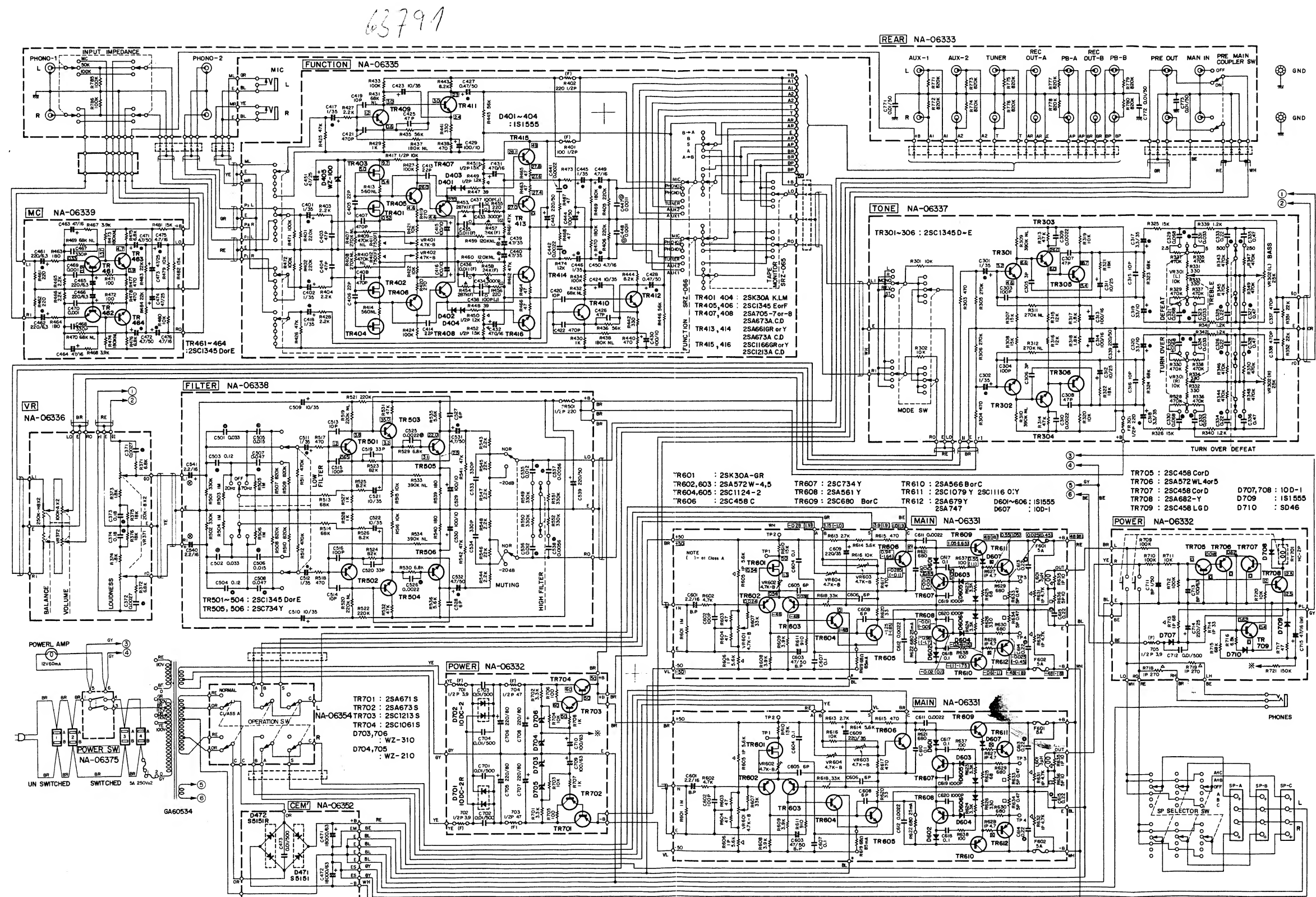
WIRE COLOR ABBREVIATIONS

BL ▶ Black	VI ▶ Violet
BR ▶ Brown	GY ▶ Gray
RE ▶ Red	WH ▶ White
OR ▶ Orange	GG ▶ Light Green
YE ▶ Yellow	SB ▶ Light Blue
GR ▶ Green	PK ▶ Pink
BE ▶ Blue	

SYMBOL	PARTS NAME
	FUSE RESISTOR
	METAL OXIDE RESISTOR
	CEMENT RESISTOR
NO MARK	CARBON RESISTOR
	CEMENT MOLDED RESISTOR
	METALIZED FILM RESISTOR

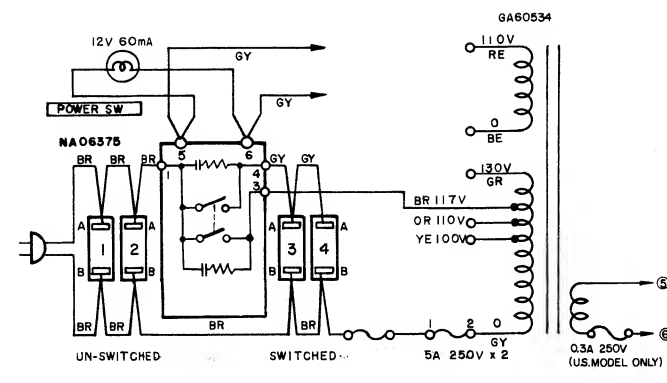
SYMBOL	PARTS NAME	REMARKS
	MYLAR CAPACITOR	
NO MARK	CERAMIC CAPACITOR	
	POLYSTYRENE CAPACITOR	
NO MARK	(BI-POLAR) ELECTROLYTIC CAPACITOR	
	LOW-NOISE ELECTROLYTIC CAPACITOR	
	TANTALUM CAPACITOR	

OVERALL SCHEMATIC DIAGRAM

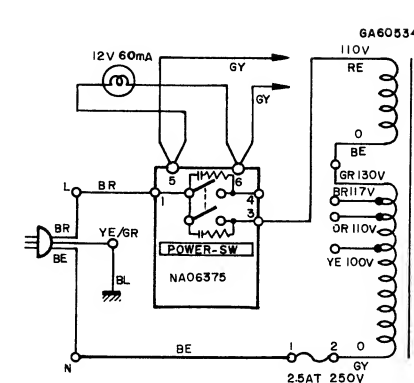


PARTIAL CHANGES MADE ACCORDING TO DISTINATION

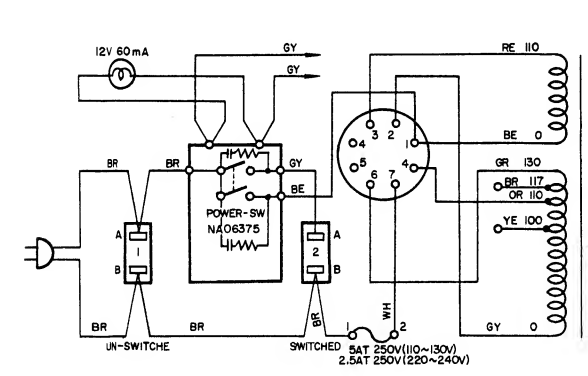
- U.S. & CANADIAN MODELS



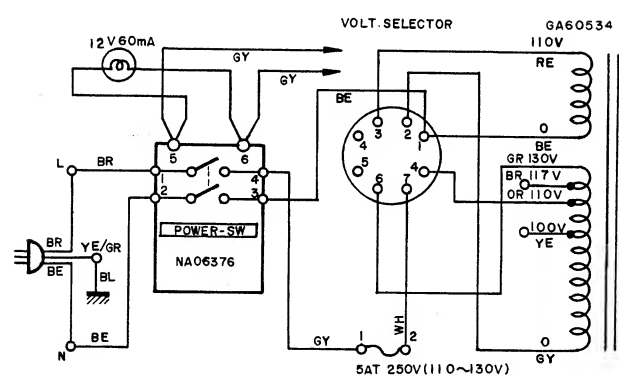
- AUSTRALIAN MODEL



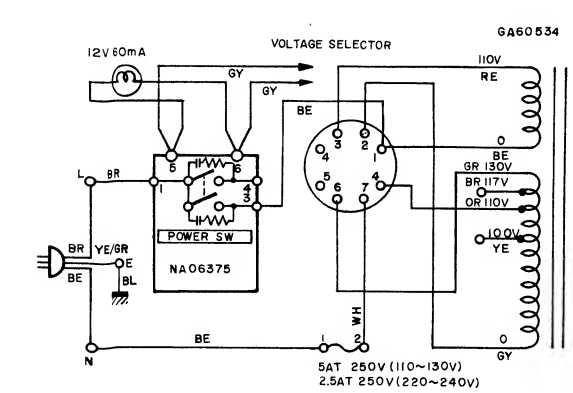
- GENERAL MODEL

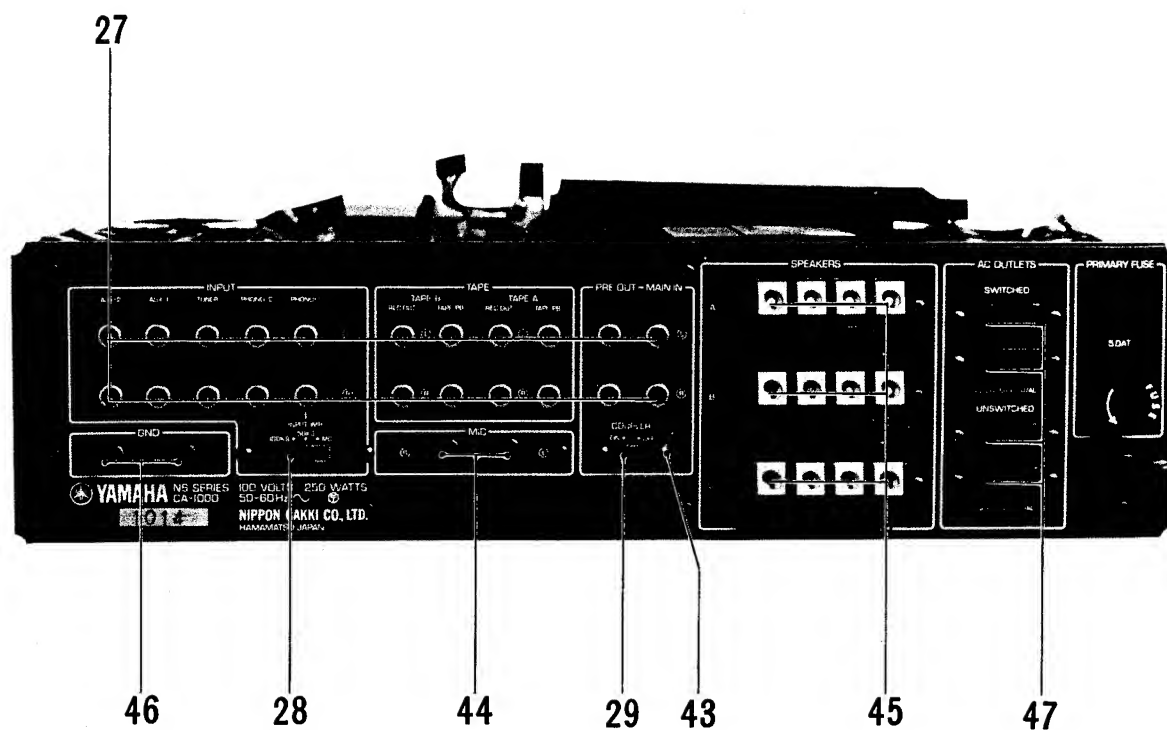
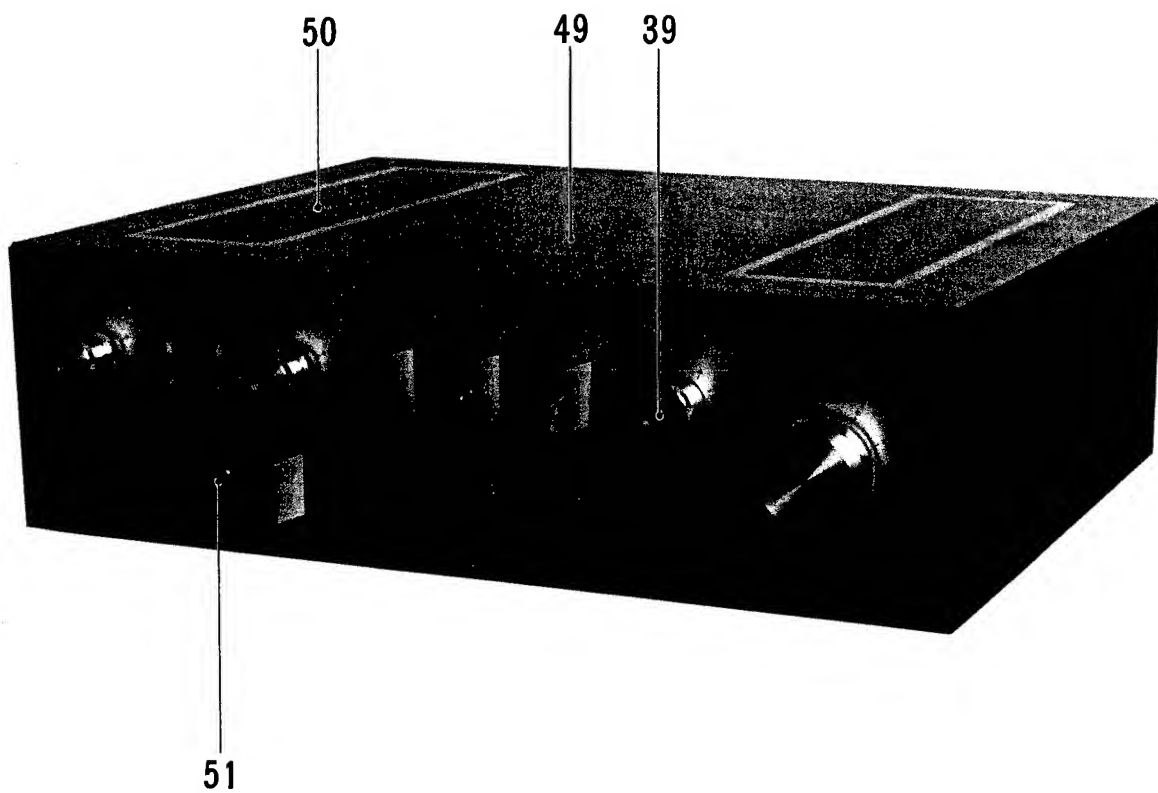


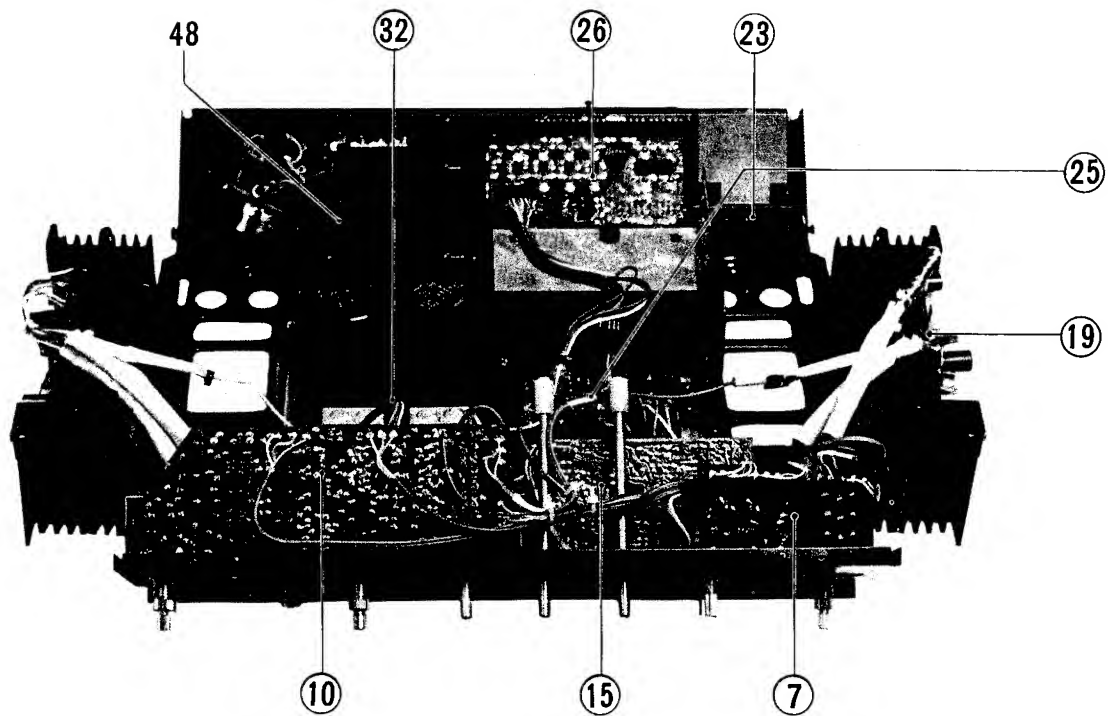
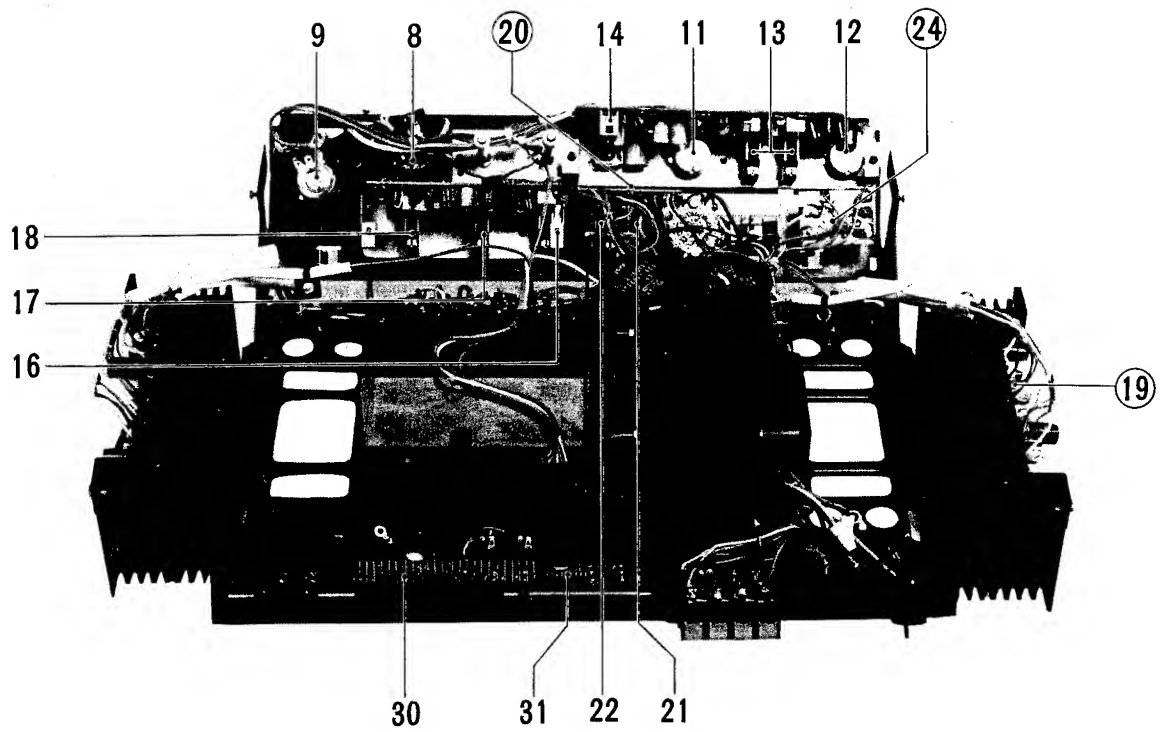
- EUROPEAN MODEL

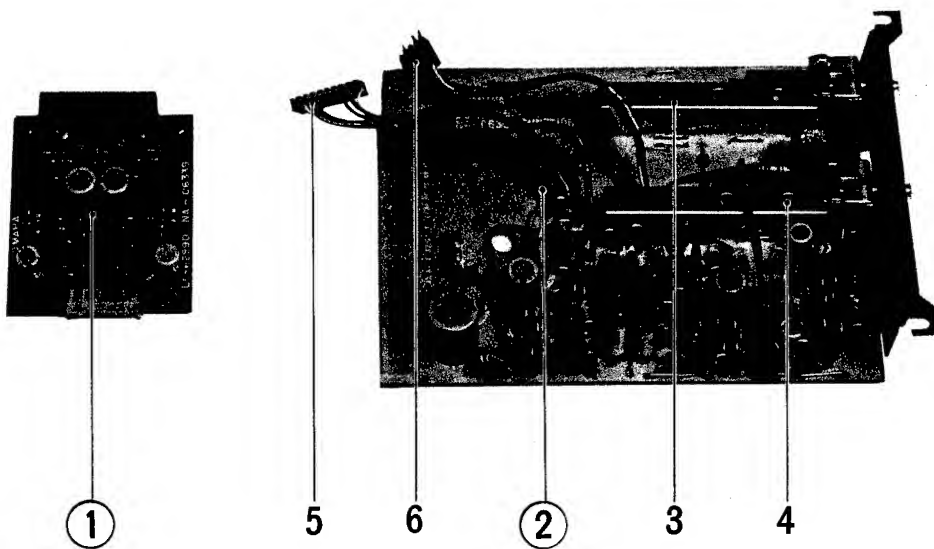
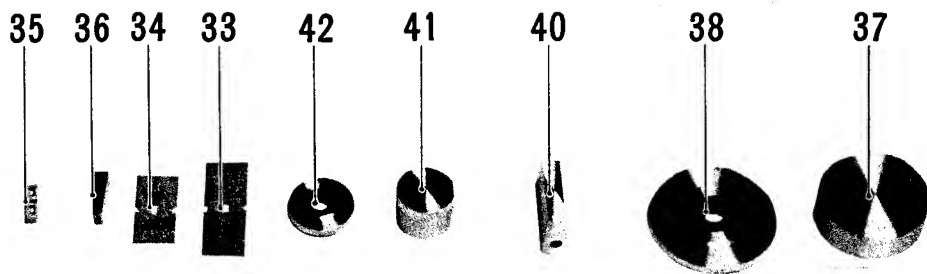


- SOUTH AFRICAN MODEL









Ref. No.	Part No.	Description			Remarks	Common Models
①	NA06339	MC AMP. Circuit board #62891			M C アンプシート	
	HE15768	Low Noise resistor	68K Ω	1/4W	ローノイズ抵抗	
	HE15818	"	180K Ω	"	"	
	FP51822	Tantalum capacitor	220 μ F	6.3 WV	タンタル固体コンデンサ	
	FP33647	"	4.7 μ F	16 WV	"	
	EP16647	"	4.7 μ F	50 WV	"	
	iC13454	Transistor	2SC1345	(D or E)	トランジスタ	
②	NA06335	FUNCTION Circuit board #62853			ファンクションシ	
	NA06459	"	63790		金属被膜抵抗	
	HZ00028	Metalized Film resistor	750 Ω		"	
	HZ00019	"	24K Ω		"	
	HZ00020		287K Ω			
	HL40612	Metal Oxide resistor	1.2K Ω		酸化金属抵抗	
	HL40615	"	1.5K Ω		"	
	HE15768	Low Noise resistor	68K Ω		ローノイズ抵抗	
	HE15818	"	180K Ω		"	
	HE15727	"	270K Ω		"	
	HE15847	"	470K Ω		"	
	HE15810	"	100K Ω		"	
	HZ00017	Fuse resistor	100 Ω	1/2 P	ヒューズ抵抗	
	HZ00014	"	220 Ω	1/2 P	"	
	iF00004	Diode 1S1555			ダイオード	
	iF00028	Zener Diode WZ-210			ツェナーダイオード	
	FP54610	Tantalum capacitor	1 μ F	25 V	タンタルコンデンサ	
	FP13647	"	4.7 μ F	16 WV	"	
	FP15610	"	1 μ F	35 WV	"	
	FP16647	"	4.7 μ F	50 WV	"	
	FP16547	"	0.47 μ F	50 WV	"	
	FP15556	"	0.56 μ F	35 WV	"	
	iA06613	Transistor	2SA661GR	(Y)	トランジスタ	
	iA06611	"	2SA661	(Y)	"	= 2SA673A
	iC11662	"	2SC1166GR	(Y)	"	= 2SC1213A
	iC13455	"	2SC1345	(F or E)	"	
	iC13454	"	2SC1345	(D or E)	"	
	iE00004	Field Effect Transistor	2SK30A	(K, L or M)	電解効果トランジスタ	

Ref. No.		Description			Remarks	Common Models	
	HT41004	Variable resistor	B4.7K Ω (SVK10R)	ソリッドポリウム			
3	KA50028	Tape selector switch	SRZ-065	テープ切換スイッチ			
4	KA50027	Function Switch	SRZ-066	ファンクション切換スイッチ			
5	LB60028	6P connector	02145-6A	6Pコネクター			
6	LB50005	5P "	CIS socket	5Pコネクター			
	LB10016	CIS Keying Pin		禁止ピン			
⑦	NA06336	VOLUME Circuit board #62861		ポリウムシート		CA-800 CA-600	
8	HS12034	Variable resistor	B20K Ω x 2	ラウドネスポリウム			
9	HS12031	"	HB250K Ω x 2, A100K Ω x 2	レベル及びバランスポリウム			
⑩	NA06337	TONE CONTROL Circuit board #62874		トーンコントロールシート			
	HE15827	Low Noise resistor	270K Ω ¼ W	ローノイズ抵抗			
	HE15839	"	390K Ω "	"			
	HZ00014	Fuse resistor	220 Ω ¼ W	ヒューズ抵抗			
	FP52733	Tantalum capacitor	33 μ F 10 WV	タンタル固体コンデンサ			
	FP15610	"	1 μ F 35 WV	"			
	FP15633	"	3.3 μ F "	"			
11	HS12033	Variable resistor	8Z-10K x 2	11点クリップ付トレブル用			
12	HS12032	"	9Z-25 x 2	11点クリップ付バス用			
	IC13454	Transistor	2SC1345 (D or E)	トランジスタ			
13	KA20014	Lever Switch	SLA-34301	ターンオーバースイッチ			
14	KA50029	"	SRZ-045	モード切換用			
⑮	NA06338	FILTER circuit board #62883		フィルターシート		CA800	
	HE15822	Low Noise resistor	220K Ω ¼ W	ローノイズ抵抗			
	HE15839	"	390K Ω "	"			
	HZ00014	Fuse resistor	220 Ω ¼ W	ヒューズ抵抗			
	FP13622	Tantalum capacitor (BP type)	2.2 μ F 16 WV	タンタル固体コンデンサ			
	FP15610	" (")	1 μ F 35 WV	"			

Ref. No.	Part No.	Description			Remarks	Common Models	
	FP16647	Tantalum capacitor (BP type)	4.7 μ F	50 WV	タンタル固体コンデンサ		
	iC07342	Transistor	2SC734 (Y)				
	iC13454	"	2SC1345 (D or E)				
16	KA20014	Lever switch	SLA34301		ローフィルタースイッチ		
17	KA20012	"	SLA34302		ミューティングスイッチ		
18	KA20016	"	SLA32301		ハイフィルタースイッチ		
①9	NA06331	MAIN AMP Circuit board # 62816			メインシート		
	HT41015	Variable Resistor (Vert. type)	B4.7K Ω	(SR-29K)	半固定ポリウム		
	HZ00021	Fire proofing resistor	4.7 Ω	1 W	不燃性抵抗		
	HL31410	Metal Oxide resistor	10 Ω	1 W	酸金抵抗		
	HL31647	"	4.7K Ω	"	"		
	HL31656	"	5.6K Ω	"	"		
	HM55247	Cement resistor	0.47 Ω	5 W	セメント抵抗		
	HM55410	"	10 Ω	"	"		
	FM11747	BP capacitor (Vert. type)	2.2 μ F	16 WV	バイポーラケミコン		
	FM09622	"	47 μ F	50 WV	"		
	GD900005	Air core coil	3 μ H		空芯コイル		
	HZ00057	Fuse resistor	68 Ω	85 mA			
	HZ00060	"	680 Ω	25 mA			
	iA05612	Transistor	2SA561 (Y)		トランジスタ		
	iA05662	"	2SA566 (B or C)		"		
	iA05720	"	2SA572 (W-4.5)		"		
	iC04583	"	2SC458		"		
	iC06802	"	2SC680 (B or C)		"		
	iC07342	"	2SC734 (Y)		"		
	iC11242	"	2SC1124-2		"		
	iA07471	Power Transistor	2SA679Y or 2SA747Y		パワートランジスタ		
	iC11161	"	2SC1079Y or 2SC1116Y		"		
	iF00004	Diode	1S1555		ダイオード		
	iE00002	Field Effect Transistor	2SK30A GR		電界効果トランジスタ		

Ref. No.	Part No.	Description			Remarks	Common Models
	LB30011	Transistor socket	S2-110B-00	トランジスタソケット		
	BA06450	Heat Singk		放熱板		
	BB06308	Fixing metal		トランジスタブラッシング		
	LB20057	Fuse Holder-pin		ヒューズホルダーピン		
20	NA06354	OPERATION Circuit board #63091		オペレーションスイッチシート		CA800
21	KA20012	Lever switch	SLA34202	レバースイッチ		
22	KA60009	Micro switch	V-10-1A	マイクロスイッチ		
	LB50005	CIS 5P socket		CIS 5Pソケット		
	LB10016	CIS Keying pin		CIS キーイングピン		
	NB06636	Operation mechanism Ass'y		オペレーション金具 Ass'y		
23	NA06374	CONNECTOR Circuit board #63241		コネクタシート		
	LB60027	Morex connector-pin No.2183-6A		モレックスコネクタピン		
24	NA06375	POWER SWITCH circuit board #63251		パワースイッチシート		CA-800, CA-600
	KA20010	Power switch	JL-04	パワースイッチ		
	FZ00011	Spark Killer	0.003 μ F x 120 Ω	スパークキラー		
25	NA06332	POWER Circuit board #62823		電源シート		CA-800
	HZ00016	Fuse resistor	3.9 Ω 1/2 W	ヒューズ抵抗		
	HZ00015	"	47 Ω "	"		
	HL41433	Metal Oxide resistor	33 Ω 1 W	酸化金属抵抗		
	HL41468	"	68 Ω "	"		
	HL41527	"	270 Ω "	"		
		Electrolytic capacitor (Vert type)	47 μ F 16 WV		ku type	
	FM10810	BP capacitor	100 μ F 6.3 WV	バイポーラケミコン		
	FM11610	"	1 μ F 50 WV	"		
	KC00008	Relay	HC-2P DC-12V	リレー		

Ref. No.	Part No.	Description			Remarks	Common Models	
	IA05720	Transistor	2SA572 (W-4.5)	トランジスタ			
	IA06719	"	2SA671S (B or C)	"			
	IA06739	"	2SA673S (B or C)	"			
	IA06820	"	2SA682 (Y)	"			
	IC04583	"	2SC458 (C or D)	"			
	IC10618	"	2SC1061S (C or D)	"			
	IC12139	"	2SC1213S (B or C)	"			
	IC0456	"	2SC458 Lg.D				
	IH00003	Diode	10D-1	ダイオード			
	IH00005	"	10DC-2	"			
	IH00013	"	10DC-2R	"			
	IF00004	"	1S1555	"			
	IF00002	"	SD-46	"			
	IF00028	Zener Diode	WZ-210	ツェナーダイオード			
	IF00022	"	WZ-310	"			
②⑥	NA06333	REAR PANEL Circuit board	# 62835	リヤパネル			
27	LB10014	Pin Jack (for Circuit board)		プリント基板用 ピンジャック			
	LB60027	Connector Pin		コネクターピン			
28	KA40020	Slide switch (Phono)	SL243B4BM	フォノインピー ダンス切換用スイッチ			
29	KA40021	" (Coupler)	SL222B4	カブラー スイッチ			
30	LB40008	CIS 4P Connector Socket		C I S 4 P コネクターソケット			
31	LB60025	CIS 9P Connector Socket		C I S 5 P コネクターソケット			
	LB10016	CIS Keying Pin		禁止ピン			
③②	NA06352	ELECTROLYTIC CAPACITOR Circuit board	# 63181	ケミコンシート			
	FZ00012	Electrolytic capacitor (Lug type) 1800 μ F	63 WV	電解コンデンサ			
	IH00021	Silicon Diode	S-5151 (RED)	シリコン整流器			
	IH00022	"	S5151R (BLACK)	"			
	CB06964	Rubber Spacer		ゴムスペーサ			

